Electrical West

With which is consolidated the Journal of Electricity

A McGraw-Hill Publication | DECEMBER 1, 1928 | Twenty-five Cents Per Copy

A Message to the Trade

Sales plans of the Pacific Gas and Electric Company for 1929, as in the past, are being prepared so as to promote dealer participation to the fullest extent.

Prices and terms for installment purchases will be such as to offer to the dealer an opportunity to cooperate with PROFIT to himself.

Advertising carried in newspapers and elsewhere will direct inquiries to the "NEAREST DEALER"

Statistical studies show clearly that of the possible field, only 10% can be covered by Company salesmen, leaving 90%—partly sold—available for cultivation by the dealers.

A united industry, working in harmony for the extension of electric service in the home will give the consumers the desired service and at the same time result in a greater volume of business for those participating.

Cooperation to the fullest extent is the foundation of our sales policies and we will welcome at any time constructive suggestions that will lead to better service for the public.

Our 1929 program will afford dealers many opportunities. For particulars communicate with our nearest office.

PACIFIC GAS AND ELECTRIC COMPANY

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245 Market Street
SAN FRANCISCO

H. M. Crawford.

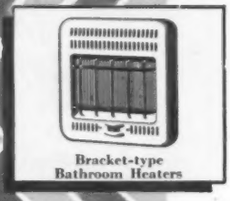
General Sales Manager

PACIFIC GAS AND ELECTRIC COMPANY — PACIFIC COURTEOUS CONTINUOUS SERVICE

Combination Hotcake and Waffle Iron

Convenience Outlet Portable Heaters

Heavy Duty Portable Heaters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Built-in Bathroom Heaters

Heavy Duty Built-in Heaters

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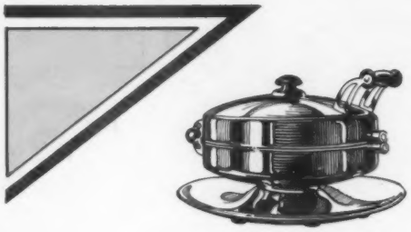
SATISFY THAT DESIRE



EVERYONE enjoys good eats and a warm, cozy spot in which to relax.

What combination can satisfy these two desires as successfully as those articles which have established a tremendous Consumer preference and demand by their merit and serviceability—

MAJESTIC

Hotcake and Waffle Iron

Portable Heaters

You are in for a big rush for Majestic Waffle Irons and Heaters because they have been advertised consistently and energetically to the buying public.

Be prepared to meet the Holiday volume with complete stocks of Majestic products.

MAJESTIC ELECTRIC APPLIANCE CO., INC.

Kansas City San Francisco Philadelphia

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W. A. CYR, *Associate Editor*
G. R. HENNINGER, *Associate Editor*

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G. C. TENNEY, *Managing Editor*
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B. H. SNOW, *Northwest Editor*

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C. T. HUTCHINSON
Editorial Director

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G. C. TENNEY
Managing Editor

Volume 61 | San Francisco, December 1, 1928 | Number 6

ANOTHER interested branch of the industry has arisen to state in unmistakable terms its opinions of the practice of "trimming" down wiring installations in order to beat competitors. The electrical workers' union in Chicago recently inaugurated a system of fines against electrical contractors who cut their jobs. The penalty of $5 per outlet trimmed out of the original plans should make any contractor pause before resorting to this method of cutting his price.

Humanity's Welfare Will Be First Thought of President-Elect Hoover, Engineer

AS WAS to have been expected, the fact that the President-elect of the United States, Herbert C. Hoover, is an engineer by profession is giving rise to much speculation. His engineering training presents a novel situation to politicians. They do not understand what "engineer" means in terms of its bearing on the problems of state.

An engineer, to the layman, is a man of more or less mystery, a man who is cold, aloof, who speaks a language replete with polysyllabic terms that nobody can understand, a man of mathematics, formulas, a sort of human calculograph surrounded by blue prints, slide rules, logarithms and trigonometric functions.

What is an engineer, and what is engineering? Beginning with engines and their operation, the work of the engineer has broadened immeasurably, until basically it may be stated that engineering consists in the development of Nature's forces and their conversion to the service of mankind. The formal part of an engineer's training consists of a study of natural forces and the mathematics by which these forces are measured. When the time comes for the young engineer to go out in the world and engage in life's battle, there must enter into his calculations the human element, for which there is no formula; nor can he find the road to success without the cultivation of a broad sympathy and understanding freely applied. The depth of this sympathy and understanding is the measure of his success.

In this day and age there could be no finer foundation for any life work than an engineering education. In the first place, the engineer is taught to think and reason along logical lines, to analyze all questions from the single viewpoint of the determination of the truth. The mental processes of the engineer are the direct antithesis of superficiality; he sweeps the chaff aside and concerns himself with the wheat.

It has been said that this is an industrial age. True enough, and thinking people are beginning to realize that agriculture, too, is an industry, and that the troubles of the farmer are industrial problems susceptible of analysis and solution by the same methods fundamentally as are the problems of steel, oil or coal. Thus we have in the President-elect the engineer in the broadest sense of the word, who will bring to bear upon the Nation's problems the orderly thinking characteristic of his profession, the broad human sympathy of the man who has had in his employ some 75,000 men at one time with never a strike, and who in his keen seeking for the truth will be swayed neither by partisan consideration nor self-interest.

Truly, if Mr. Hoover has dignified the profession of engineer, the profession of engineer has likewise proved to be the foundation upon which his remarkable career is predicated. It behooves every member of the profession therefore to dispel the illusion that an engineer as a man is a thing apart from the rest of humanity. On the contrary, humanity and its welfare are the first consideration of the engineer.

Disagreements Resulting From New Code Require Joint Action for Settlement

MANY changes either are included or proposed in the 1928 National Electrical Code. It has taken only one, however, to arouse the central stations to the realization that they have a vital, although possibly overlooked, interest in the framing of this important set of industry standards. Article 9, referring to the grounding of wiring systems and appliances within the premises of consumers, has aroused a storm of protest and discussion. Several clear-cut ideas have developed as a result of the conferences and discussions that followed the publication of the code.

In the first place, the central stations realize that their interest in the code entitles them to greater representation upon the body that frames and approves it. The National Electric Light Association, through one of its committees, is requesting that the number of light and power representatives be increased to twelve. In view of the importance of the code to the evolution, progress and development of the industry, this increase in representation is warranted.

In the second place, the industry is unalterably opposed to the proposal that individual portable appliances in domestic use be grounded. By requiring the attachment of a third wire to the frame of an appliance the present wiring in eighteen million homes is made obsolete. Duplication of stocks of fittings would be necessary; interchangeability would be lost, public acceptance would be set back immeasurably.

Several substitute procedures have been offered in place of enforcement of the grounding proposal. It has been pointed out that further insulation might accomplish the same purpose. There is a relationship between grounding and insulation that can be worked out only with more study. The suggestion has also been made that the sale of sub-standard appliances—and these are the ones that are largely to blame for the fatalities behind the demand for grounding—be prohibited by the code. This could be done through enforcement of a

section prohibiting the sale of any appliance that does not meet the requirements of the National Board of Fire Underwriters or some similar inspection organization.

However, the fact remains that a serious industry problem has developed. The solution of the code problem will require many conferences. It can be achieved only after careful study, regard for conflicting viewpoints, and practical compromise. The present disagreement does not offer so many controversial sides but that it can be settled without jeopardizing present goodwill or future progress.

Rate of Hydro-Electric Development Decreasing

INDICATION of the uncertainty surrounding the development of the remaining waterpower sites of the country is seen in the fact that only five applications reached the Federal Power Commission during the months of September and October. Three of these were of minor importance. For the entire period since the enactment of the Federal Water Power Act applications have averaged eleven per month. Two reasons may be ascribed for the dearth of applications. One was the uncertainty regarding the attitude of the Democratic administration toward water power development, had that party been successful in the November elections. Fortunately, this has been removed. The other is the increasing importance of steam-generated power due to the marked improvement in efficiencies of boilers, turbines and other equipment. Further development of water power may be expected, but not at the rate of the past decade.

California's Efforts to Clarify Question of Riparian Rights

IN AN endeavor to modify the original principle of riparian rights based on the old English common law, voters of California at the November election passed a constitutional amendment establishing the policy that riparian rights shall extend only to the beneficial use of the waters of California streams. Briefly, the amendment provides that the "general welfare requires that water resources be beneficially used," that "waste or unreasonable method of use be prevented," and requires that the principle of "conservation for public welfare" be followed in the future. It declares that "rights in a stream or water course shall be limited to water reasonably required for beneficial use" and to the "riparian rights attaching to the flow required, and shall not extend to waste or unreasonable use or unreasonable methods of diversion."

Water law in California was established in 1850 with the adoption of the English common law interpretation which granted to every property owner a vested right to the natural flow of any watercourse adjacent to or passing through his property. It has been the subject of interminable litigation and was the underlying cause of the famous Herminghaus suit against the Southern California Edison Company to enjoin it from storing water for power generation in mountain areas. The present amendment grew out of many conferences that followed that suit. It met with universal favor and was passed by a substantial majority.

Its effectiveness, however, has been the subject of much conjecture. Attorneys are of the opinion that it will have little effect in clarifying the complicated situation that has hampered the development of water resources for power and irrigation use. This opinion is borne out in the recent decision in the case of *Collier vs. Merced Irrigation District* in which the court implied that the new amendment is unconstitutional. In awarding damages to the plaintiff for the loss of riparian rights due to storage of water by the irrigation district, the court explained its opinion in the following language:

"I take the position that the state cannot authorize the riparian rights of any individual to be taken from him without compensating that individual for his loss."

The constitutionality of the measure can be decided only after a case has been carried to the State Supreme Court. It had been hoped that the amendment would afford some measure of relief. It is doubtful, however, whether the courts will recognize its provisions. The outlook is for further litigation until such time as the courts accept a more liberal interpretation of the doctrine of beneficial use.

Election Influences on the Colorado River Problem

VARIOUS influences on Boulder Dam have developed as a result of the election. In a test vote sponsored by the Colorado River Aqueduct Association Los Angeles and ten other southern California municipalities voted in favor of organizing a metropolitan water district after Boulder Dam has been built. Immediately the Los Angeles City Council voted $10,000 to be used for lobbying purposes in order that members of the House and Senate might be advised of this and other reasons why the measure is desirable from the standpoint of southern California.

Other powerful influences that might affect the outcome of the bill in Congress were: the re-election of California's Senator Johnson, arch-proponent of the measuse; and the surprising defeat of Democratic incumbent George W. P. Hunt for the governorship of Arizona. Sole occupant of the gubernatorial chair of Arizona since its admission to statehood in 1912 and staunch opponent of Boulder Dam, ex-Governor Hunt ascribes his defeat to the outspoken advocacy of Boulder Dam by the Democratic presidential nominee. However, Senator Ashurst (Democrat), an equally sturdy supporter of Arizona's rights, was re-elected. In Utah, both Governor Dern and Senator King, also opposed to the Swing-Johnson Bill, were returned to office.

Meantime, speculation is rife regarding the recommendations that will be contained in the report of the committee of engineers appointed by the Secretary of the Interior to study the engineering aspects of the project. President Coolidge has indicated that the report will receive careful study before the administration makes any further recommendations.

At present it is impossible to prophesy what action the Senate will take on the Swing-Johnson Bill when Congress convenes in December. The bill has passed the House and is the first order of business in the Senate. Should it have the good fortune to be passed and signed by the President, the likelihood remains that it would remain inoperative because of its own provisions and the avowed declaration of Arizona to shift the scene of action from legislative halls to the courts.

Should the bill fail, a sound recommendation to President-elect Hoover would be to wipe the slate clean and make a new beginning. Removed from politics, and with state differences adjusted through understanding and a desire to co-operate, the problem of the Colorado River might possibly be solved.

"Sandy" Pratt's Christmas Tree

"SANDY" PRATT sells gravel for his living. It is built into the highways crossing and recrossing the state, and has written itself quite generally upon the map of California. If Clarence F. Pratt's name also is written into state sagas it will not be for his gravel, but rather because it is written in Christmas trees and gay festoons of cheerful colored lights, as president of the Outdoor Christmas Tree Association of California.

Mr. Pratt's interest in Christmas trees began casually enough some time ago. His home is situated on the side of Twin Peaks in San Francisco. A stately evergreen grows tall and slender in his own front yard. One year he decided to light it with colored lamps. The boys at one of his yards caught the spirit. They made up strings of lamps and helped decorate it.

Last year a little boy, ill in bed, living in the neighborhood, asked a special favor. Would his mother move his bed near the window so that he could see Mr. Pratt's tree all lighted up?

That settled it for Mr. Pratt. Every home in California, he decided, might well have its own front yard Christmas tree, lighted so all might see and take cheer during the entire holiday season.

He interviewed park officials, forestry and conservation enthusiasts. He saw chambers of commerce, civic leagues, city, county and state officials. To all of them he preached the reasons for California outdoor Christmas trees. He stirred women's clubs and men's service clubs to action. He asked the electrical industry to help.

He was not particular how individuals or organizations carried on their Christmas decoration programs just so they did. There was no idea of duplication or competition, of contests or drives in his mind. What he wanted most of all was that each family plant a tree, if it had none already in its yard, and decorate it. "We want the poor homes to be able to light up a tree as well as the well-to-do," he said.

Just as the boys at his yards caught the spirit, the whole state caught it too. In southern California Mary Pickford accepted an invitation to head a community organization to foster outdoor Christmas decorations only if she be allowed to work hard on the committees. Her example inspired others. Thus the movement has grown.

Of all those interested in the movement none have so complete a reason for entering whole heartedly into the program as the electrical industry. This industry's interest, beside the sufficient one of sentiment and public spirit, stands solidly upon good commercial ground as well, if such is needed. Every lighted lamp at the Christmas season has in it an increment for the central station, the manufacturer, jobber and dealer, even the contractor. The least those in the industry can do is to set an example which others will be glad to follow, by lighting their own front yard trees early in December, early enough to remind and inspire others to do likewise.

There may be no snow in most California communities this year. Yet this omission of nature will not keep its people from exhibiting their many individual and community trees brilliant with light and color. There will be no lack of Christmas cheer, snow or none.

"Sandy" Pratt's Christmas tree, which last year brought joy to the little sick boy, has spread its illuminated evergreen branches over the entire state this year.

Real Estate Speculation Based on Boulder Dam Project

MANY fortunes have been made in real estate. In fact, the business of buying and selling land and buildings has been so profitable that it has attracted the speculative or gambling interest of the public. As a result much money has been made and much also has been lost, with the small investor as the principal victim. As with mining, oil or the stock market, a real estate boom is based upon an implied promise of large profit plus a glamour that is derived chiefly from ample publicity.

Just at present in the Pacific Southwest Boulder Dam is acting in the role of "come-on" for real estate operators who are subdividing sections of the arid desert in both Nevada and California. Here are extracts from an advertising appeal to the "man of moderate means" who desires "to make a fortune without gambling":

"Coolidge, Hoover, Johnson, Swing and scores of others of the country's biggest men are behind the project that will bring riches to Chemehuevis Valley. Boulder Dam will change Chemehuevis Valley from a desert waste into one of California's most luxurious valleys. Rich and fertile . . . capable of growing anything that can be grown in sub-tropic climate . . . Chemehuevis Valley only awaits the magic touch of water to become valuable farm land. Other desert valleys have averaged 1,500 per cent increase in land values as a result of development."

The "man of moderate means" learns further that "Boulder Dam is practically assured"; that "the biggest men in the country are for it." As an echo of the election he finds out that "fighting Senator Johnson goes back to Congress this year to put Boulder Dam across." He is told that "when the Boulder Dam bill passes prices on all remaining property will be immediately raised . . . Chemehuevis Valley will witness one of the greatest land booms this country has ever seen!" He has a reasonable assurance of safety because "no other project this country has ever seen has had so many big men behind its success as has Boulder Dam."

Nevada operations of the real estate subdividers have aroused the California State Real Estate Commisisoner to take action against dealers who are selling desert "business" lots to California investors. Subdivisions have been opened on the desert adjacent to Las Vegas, Nev., on the theory that this city will become a thriving metropolis when Boulder Dam becomes a reality. Besides Vegas Manor, Arrowhead Acres and Vista del Mar, all subdivisions near Las Vegas, Commissioner Stephen Barnson investigated Boulder Dam Park, a resort property located on the edge of the purported Boulder Canyon reservoir. He has declared that 1929 licenses will be withheld from every California real estate dealer and salesman that is connected with any of the Nevada desert projects.

It is open to question whether the present generation will witness the fruition of many of the promises of the real estate operators. A dam is required on the Colorado River to provide flood control and storage for irrigation and domestic water supply, as well as by-product power. This may be Boulder Dam or it may be a structure far removed from that site. In the meantime it is fortunate that the public can be protected, at least partially, from losses that might accrue from speculating upon land values contingent upon anything as nebulous as the final completion of Boulder Dam.

Utility Offices in Holiday Attire

NO POWER company office should remain undecorated by the best holiday lighting this year. The utility should lead the community in this respect. Last year the Great Western Power Company's offices at San Francisco (above) and The Washington Water Power Company's at Spokane were particularly attractive.

A New Electrolytic Zinc Reduction Plant *for the West*

By **Ellery R. Fosdick**

Assistant Engineer, The Washington Water Power Company, Spokane.

ELECTRO-METALLURGY has taken another forward step through the completion of the Sullivan Mining Company's new electrolytic zinc plant near Kellogg, Idaho. This plant was completed and placed in operation September, 1928, and represents the first application on a commercial scale of the Tainton process which has been experimented with for some years. The first units of this plant are designed to produce 50 tons of zinc per day and represent an electrical load of about 10,000 kva. which is supplied from the lines of The Washington Water Power Company.

Electrolytic processes have played a prominent part on a commercial scale for at least the past fourteen years in the successful and economical reduction of complex zinc ores. The Tainton process, which has emerged from the experimental stage in the Sullivan company's Kellogg plant, differs in several details from the older electrolytic processes. The most notable differences are the higher voltage and higher acid concentration that are used in the Tainton process. This new process is being watched with great interest by metallurgists because its proponents believe it to be more advantageous than the older processes in respect to production cost and in the purity of the refined metal.

The new plant will handle zinc concentrate from a concentrating mill at Kellogg and similar mills elsewhere and thus will afford an outlet for the refractory and complex zinc ores of the Coeur d'Alene district of northern Idaho. The zinc concentrate is roasted and the roasted calcine is magnetically separated into two parts. One of these parts is the magnetic portion containing most of the iron and zinc ferrite which is formed in roasting the ore. The second part contains all of the non-magnetic material which is practically entirely zinc oxide. The magnetic portion containing the zinc which is not readily soluble is mixed with 28 per cent acid which attacks and dissolves the zinc compound. The oxide portion then is added to this pulp to neutralize the unconsumed acid and to precipitate iron and other impurities which have been dissolved.

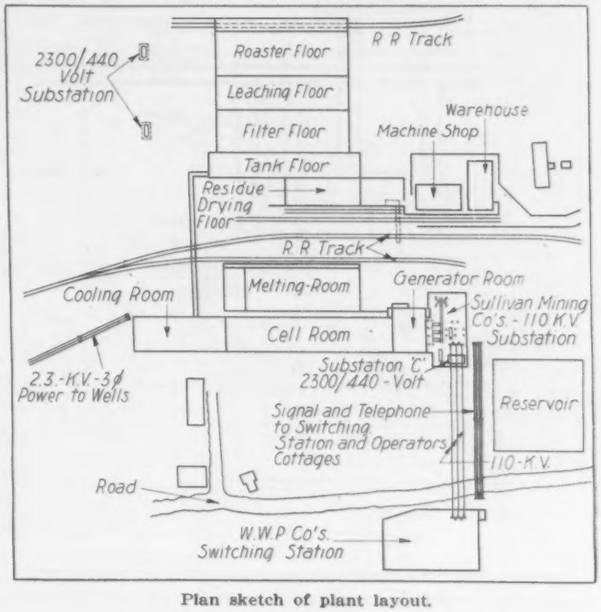
The pulp then is filtered from the resulting solution and dried. This residue, which contains the lead and silver that was in the original zinc concentrate, is shipped to a smelter for the recovery of these metals. The zinc sulphate solution is agitated with metallic zinc to precipitate cadmium, copper and cobalt and then is filtered again to remove solids and the neutral zinc sulphate solution goes to the electrolytic cells.

These electrolytic cells operate with an acid concentration ranging between 22 and 28 per cent sulphuric acid. This is appreciably higher than the concentration used in the Anaconda process and is one of the features of the new Tainton process. When the acid concentration reaches the upper limit, a portion of the solution is withdrawn from the cell solution circuit and a corresponding volume of neutral zinc sulphate solution is added to replace it, thus reducing the acid strength in the cells to the lower limit. The strong acid which is withdrawn is used in the leaching of the calcine as previously mentioned. Thus to this extent the process is cyclic although the actual electrolysis and electrodeposition is a continuous process. The heat developed in electrolysis is dissipated by means of lead-pipe cooling coils carrying cold water and placed in lead-lined boxes through which the electrolyte is circulated.

Each cell contains ten aluminum cathodes and twenty lead anodes. The lead alloy anodes are made in the form of flat grids, liberally perforated, while the aluminum cathodes are smooth flat sheets. This design together with the grouping of two anodes for each cathode (1) facilitates the flow of electrolyte between anodes and cathodes, (2) reduces the current density in the anodes and thus reduces electrical losses which result in higher cell efficiency, and (3) reduces gassing at each anode, thus improving the contact efficiency.

The purified zinc sulphate solution is sent directly to each one of the 300 cells and is constantly recirculated until approximately 90 per cent of the zinc has been extracted from it. The purified solution going to the sells contains more than 20 per cent zinc, and the liquor returned to the agitator tanks after the zinc is removed contains approximately 28 per cent sulphuric acid. The cell solution is circulated continuously and at intervals a portion is removed to the acid storage tanks. The electrolysis is continuous so that the electrolyte gradually is depleted of its zinc content and increased in acidity whereas the process in respect to the electrolyte itself is cyclic in its operation.

The decomposition voltage of zinc sulphate is 2.36 volts, but the minimum allowable voltage per cell in the Kellogg plant is 3.1 volts per cell, in order that zinc may be positively deposited on the cathodes. The potential drop per cell depends upon several factors, such as conductivity of the electrolyte and the state of decom-



Plan sketch of plant layout.

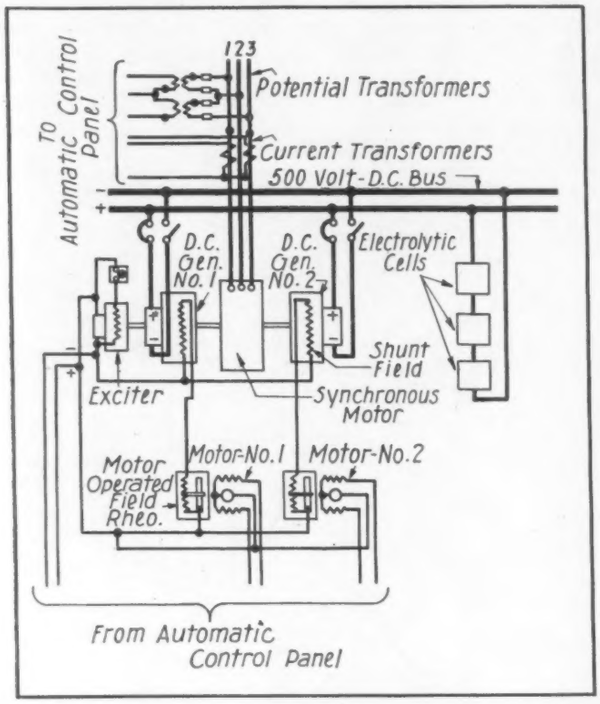
position of the electrodes. Due to the fact that several of these variables may be subject to change in practice or upon further developments of the process, the plant design provides a possible range of from 3.4 to 3.7 volts per cell with an average of 3.55 volts per cell.

As indicated in the foregoing discussion the 150 cells of any one group are connected in series with a current of 8,000 amp. flowing. The current density at the surface of the aluminum cathode is slightly less than 100 amp. per square foot. The maximum limit of this current density is dependent upon the economics involved in the amount of cooling necessary to dissipate the heat generated and in the necessity of keeping power consumption down to the proper value.

Calculations of zinc tonnage and other related factors are based upon 85 per cent average current efficiency expected. The electrolytic zinc deposited upon the aluminum cathodes is stripped at intervals varying from 12 to 24 hours and the stripping is done without interrupting the circuits. By means of short-circuiting bars a single cell may be cut out of the circuit while the stripping is carried on in that cell.

Power for the plant is supplied normally by The Washington Water Power Company through a 110-kv. transmission line from the East Side substation at Spokane and a 60-kv. line direct from the Post Falls generating plant of that company. Continuity of service further is insured by a third line operating at 110 kv. and extending from the plant switching station through the larger substations of the Coeur d'Alene mining district, joining near Burke, Idaho, a 110-kv. line from the Montana Power Company's Thompson Falls plant.

The private substation of the Sullivan Mining Company has a 10,000-kva. transformer bank protected by an oxide-film lightning arrester and a 110-kv. oil circuit breaker. The transformer bank steps down from 110 kv. to 2.3 kv. at which voltage five major plant feeders distribute power throughout the establishment. Two General Electric double-ended synchronous motor-generator sets are provided in the initial installation to supply the necessary direct current for the two groups of electrolytic cells in the first unit of the plant. Although the efficiency of this type of machine is somewhat less than the efficiency of synchronous converters, the synchronous motor-generator sets were selected for the Kellogg plant because (1) they are more stable and less affected by transmission surges, (2) automatic regulation is easier to attain than with synchronous converters, (3) motor-generators have a wider range of operating voltage, (4) the synchronous motor may be used to correct the power factor of the total plant load, and (5) only one 110-kv. transformer bank and one 110-kv. oil circuit breaker were needed whereas synchronous converters producing 500 volts d.c. would have required another bank of transformers and related equipment. Each of the motor-generator sets comprises a 4,400-kva., 2.3-kv., 514-r.p.m. synchronous motor driving two 4,000-amp., 500-volt, shunt-wound, d.c. generators with a direct-connected exciter supplying field current for both motor and generators. Each generating unit with its normal output of 8,000 amp. at 500 volts d.c. supplies one 150-cell electrolytic group.



Scheme of electrical circuits in the electrolytic end of the plant. Full automatic control and regulation is provided for each machine.

The cyclic variation in conductivity of the electrolyte together with periodic shutdowns of various electrical apparatus for cleaning, oiling and other attendance made it imperative to adopt some means of obtaining constant power input to the synchronous motors in order to maintain the desired load factor. Complete automatic regulating equipment for this purpose was supplied with the machines.

One of the features of the electrical installation was the arrangement for protective ventilation for the motor-generators to guard against any possible damage from the acid-bearing fumes so common to an electrolytic plant. Even though the major amount of gas from the plant is discharged from a high stack located at a distance from the plant, nevertheless other precautions were thought desirable. A semi-enclosed system of machine ventilation accordingly was installed, the generator building itself being used as the enclosure surrounding the machines. Air normally is recirculated from the generator room through carrier air washers located in the basement, which system places the inside of the building under a static pressure of about ⅛ in. in the generator room and ⅝ in. in the basement. Thus any leakage that may occur is from the building rather than into the building. This eliminates entirely the possibility of any acid gas fumes entering the machine and switchboard room. The temperature of the air flowing into the air washers is maintained automatically by means of thermostats which control interlocked louvers, the operation of which permits a certain amount of outside air to be drawn in through the air washers to supplement and further cool the recirculated air when and as needed.

A Cottrell precipitator which removes more than ten tons of zinc, lead and silver compounds in the form of dust from the flue gases from the roasting ovens, and a notably complete installation of individual motor drives on various equipment throughout the plant also should be mentioned. Mechanical power throughout the plant is furnished by means of 440-volt, three-phase motors, and there are 156 of these motors in the plant, ranging in size from ½ to 150 hp. Safety push-button stations are used for the control of the smaller motors and hand-starting compensators protected by safety fused switches are used for the larger motors. In fact the entire electrical installation is noteworthy for the thoroughness of design and care in construction and erection. The management believed that the greatest economy was to be realized only through the installation of a system planned and installed to give maximum service with a minimum of expected maintenance.

A Five-Year Goal of

100,000 Ranges

By R. H. Ballard
President, Southern California Edison Company

As chief executive of the Southern California Edison Company, Mr. Ballard tells why he is today commercially minded.

WERE I asked the question why I, as chief executive of the Southern California Edison Company, am today commercially minded, the answer would not be difficult to find. The greatest piece of work confronting the industry and its future prosperity today is the business of scientifically and properly building up load. Let us take the case of the Southern California Edison Company for example. During the past five years the company has spent approximately $138,000,000 in development work and the estimate for the next five years is $130,000,000. However, there is a very great difference between the two amounts. During the last five years and for a longer period than that, our job has been in the development and production of power—in building generating plants, transmission lines and a basic distribution network. At the same time there was the task of bringing the financing of the company down to a more or less automatic basis.

Now the distinction between the two five-year budget amounts is that in the next five years three-fourths of the money to be spent will be devoted to the idea of getting new business as compared to one-fourth spent for that purpose during the past five years. And during the year that has just passed the business building results have been so remarkable as to give us courage to believe that even our own estimates for the next five years will be exceeded.

About a year ago while addressing a group of commercial men I made the statement that a chief executive might reasonably expect within three or four years an average annual domestic kilowatt-hour consumption of 600 kw.-hr. I was thinking then in terms of the national average of slightly more than one kw.-hr. per day. Today the Edison company has almost reached that goal with an average consumption of 554 kw-hr. I would feel secure today in setting as a goal for the next five years an average consumption of 1,000 kw.-hr. per home.

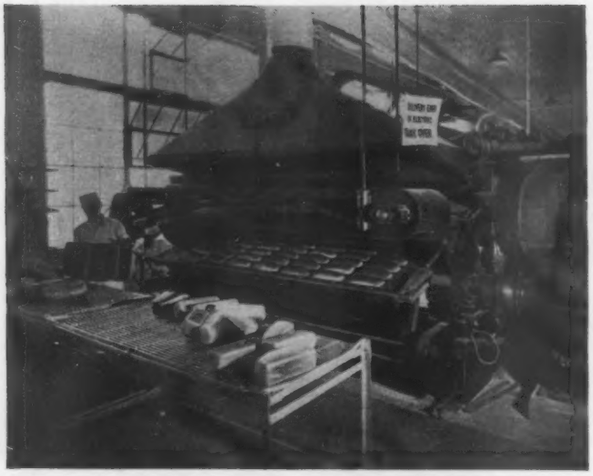
One of the appliances that will help to attain this goal is the electric range.

Engineers bear me out in the idea that the most economic basis of operation for the electric range, taking it from the standpoint of the power system, is to have a diversification to the extent of about one range to each four customers, thereby avoiding too much general expenditure going into the system without a corresponding immediate return.

If the Edison company should lay out an electric range sales program for a period of five years, we will say, in that time domestic customers will easily increase by 140,000, making the total on the Edison system 500,000. In some of our districts we now have a range to each seven domestic customers, but if we should become really enthusiastic about the business and really get down to it, get our hearts into it, we can have one range to each five customers at the end of five years. In that event we should have 100,000 ranges five years from now. We now have 15,000 range customers, which leaves 85,000 to be sold. The quota to be set, then, would be 17,000 ranges per year on the average. By that I do not mean that in the next twelve months we would sell 17,000 ranges, but if we should sell 10,000 in the next year, the momentum, the advertising value of those 10,000 new ranges—the lady who tells her friends what she does with her electric range—will bring a whole lot of ranges that we will not have to sell—they will just sell themselves.

This might mean that we would sell 10,000 ranges the first year and end up with 30,000 the last year, but no matter how the bogey is divided, it is within the power of our sales organization to accomplish the task.

Such a range campaign or any other load-building job can be accomplished by the Edison commercial department or any other commercial department if it sets out with determination and has within it the heart and spirit of the men who are directing the work as well as the executives who are lending their support. With an organization that is unified and correlated, any commercial task can be accomplished in the same way that the problems of engineering, operating and financing have been met and solved. The time has passed when there might be any separation between the commercial department and the company; they are one and the same thing. So also has the time passed when the commercial manager need worry about executive support. He has it. The chief executive today is commercially minded.



Delivery end of the large traveling oven.

Mutual Chain Stores' Operation

All-Electric

Complete maximum demand and production analyses of the electrical baking equipment, the first of their kind to be made in the West, demonstrate the possibilities for this type of load.

ELEVEN reasons are given by the Mutual Stores, Inc., of Oakland and San Francisco, Calif., for the installation of an all-electric bakery in its new headquarters, and not one of these eleven concerns itself with cost, though in this bakery costs have been brought down to new levels. In fact these eleven reasons seem to indicate that even had the power costs been much greater than they have proved under careful operating conditions, the all-electric bakery would still be preferred.

The reasons given by A. E. Link, bakery manager, for adopting electric operation are as follows:

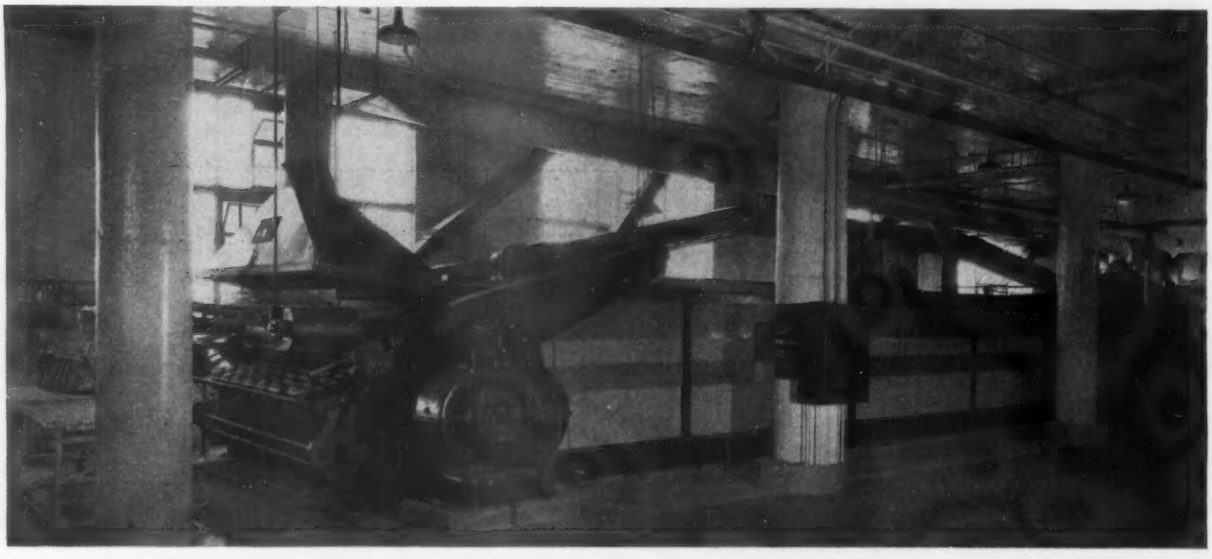
1. More thorough and even baking,
2. Crisp, brown crusts,
3. Finer texture,
4. Does not crumble,
5. Stays fresh longer,
6. Control of heat easier,
7. Flexible temperature control gives right heat for various kinds of bread,
8. Excludes possibility of explosion,
9. Public appeal in cleanly electric bakery,
10. Cleanliness (no fumes),
11. Better working conditions.

All of these reasons are familiar enough to the electrical industry. They have been its selling arguments. Support of them by the plant manager of this chain store's large baking plant is convincing proof of their soundness. Yet it is to costs that interest attaches, especially in all-electric baking on such a scale as that of the Mutual stores.

Fortunately in this instance the Great Western Power Company, serving the load, has been able to obtain from the plant records more complete data on demand, consumption and production of bread than has been possible in any previous Western installation. These data show that the bread ovens consume 97 kw.-hr. per 1,000 lb. of bread, at an average rate earned of about 1 cent per kw.-hr. Fuel cost advantage is still slightly in favor of the oil fired ovens previously used by Mutual Stores, Inc., at its former plant. Cost of heat for these oil fired ovens ranged from 60 to 70 cents per 1,000 lb. of bread. Evidently such a slight advantage, as compared to the total cost of production, was not enough to offset the advantages of electrically baked products.

The Plant

In order to take into consideration all factors entering into the operation, a brief description of the new Mutual bakery will be apropos. The Mutual stores'

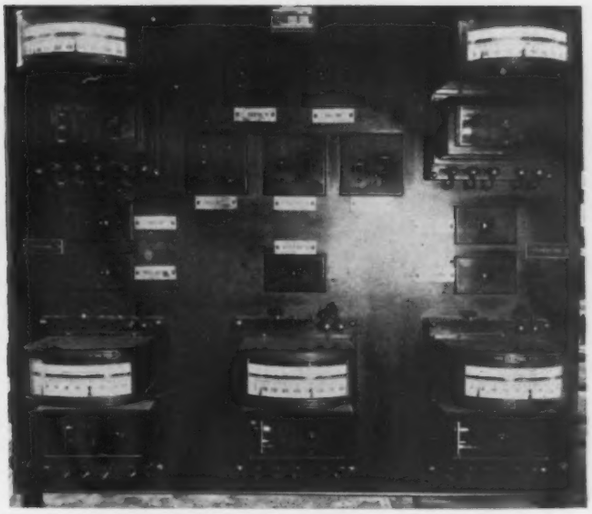


Largest traveling oven on the Pacific Coast, which bakes from 3,000 to 3,600 lbs. of bread per hour. Back of the oven, against the windows, may be seen the return conveyor for bread pans, with air cooling ducts attached at intervals.

Studies Prove That the

Bakery Pays

in Economy and Improved Product



Main control panel with oven-heat indicators, etc. This is located near the loading end of the traveling oven.

bakery, supplying all bread and pastry for 200 stores in Oakland and East Bay cities, recently occupied the main building of the company's new warehouses and plant on East Fourteenth St. In moving to the new location it was decided to make the bakery all electric. Experience with four deck-type pastry ovens had proved satisfactory in the previous location.

A traveling-type, five-section oven, 60 ft. long and 9 ft. wide, having a balanced three-phase, 220-volt connected load of 330 kw., built by Baker-Perkins Company, Inc., and equipped with General Electric elements and automatic temperature control, was added to the four pastry ovens. A complete complement of electrically driven bakery molding and shaping machinery, conveyors, elevators, pan greasers, etc., as well as ventilating and lighting equipment, has also been installed so that maximum efficiency may be obtained from the use of the traveling oven. Installation was made by the Pacific Electric Motor Company of Oakland, under supervision of G. M. Simonson, consulting engineer.

In the traveling oven 60 heaters of the B-P open-grip type, employing nichrome ribbon, are used, divided into five sections or groups of heaters. These are arranged so as to have two sections above the conveyor and three below it, each section having twelve heating units. The heaters are arranged four in series per phase, for each of the three phases, and the group is delta conected and fed from a 220-volt circuit. This gives 66 kw. per section, or a total of 330 kw.

The heater ribbons operate at a low-watt density per sq.in. so that no color is noticeable when the heaters are operating at oven temperature. Terminals of the heaters and all bus bar connections are inside the furnace in order to minimize all radiation losses as it is necessary only to bring out two wires for each phase. Well insulated doors at the end of each heater allow inspection of heaters and the making of any replacements necessary. For white family loaf bread the top sections are set to operate at 450 deg. F. and the bottom sections 540 deg. F.

Control of each section is independent and automatic. The two wires run back from each phase of heaters to the control board make possible the isolation of a particular phase in case of ground or short circuit. The temperature is regulated by five Brown, Model 857, indicating-type temperature controllers mounted on a separate panel near the loading end of the oven where the operator can watch the temperature closely.

A speed range of from 10 to 60 min. for the bread to pass through the oven is obtainable. Tests to determine best speeds for each type of bread have been made, approximately 30 to 32 min. being required for the 1-lb. loaf and 36 to 37 min. for the 1½-lb. loaf. Provision is made for introducing steam under 5-lb. pressure for "bottom" bread.

The oven operates 24 hr. per day except Sunday, and while its output is largely white bread it has been used for the following breads: family white, pullman, french, milk, cracked wheat, raisin, rye, pumpernickel, graham and whole wheat breads and buns. As a rule, however, breads requiring longer heating, such as pumpernickel, are baked in one of the deck ovens.

The maximum rate of production varies with the product. It ranges from 3,000 lb. to 3,600 lb. per hour or approximately 75,000 loaves per day.

Shortly after the oven was placed in operation tests were made by both the Mutual company and the Great Western Power Company. The complete records of these tests appear in connection with this article. (See Tables 1 and 2.) Consumption for that period of a month ran to 97 kw.-hr. per 1,000 lb. of bread, a figure which shows tendencies of being reduced as the oven

Other electric baking equipment: *Left*, a 70-kw. oven for baking rye and other breads requiring longer baking time. *Right*, molding and kneeding machinery in the production chain. Dough comes down trough from mixing rooms on second floor. Elevator conveyor takes pans loaded to a warm vault for raising the dough. *Center*, three pastry ovens in which all rolls and pastry are baked.

TABLE I—Mutual Stores, Oakland, Calif. Daily Readings 8 a.m. July 11, 1928, to Aug. 10, 1928

Date 1928	Total Load Kw.-hr.	Maximum Demand Kw.	330-kw. Traveling Bread Oven Kw.-hr.	70-kw. Deck Oven Kw.-hr.	50-kw. Deck Oven Kw.-hr.	50-kw. Deck Oven Kw.-hr.	70-kw. Deck Oven Kw.-hr.	Total Load Ovens Kw.-hr.	Total lb. of Bread Baked
July 10									40,253
11		604.8							38,920
12	8,400	604.8	4,560	240	60	180	360	5,400	40,714
13	8,400	604.8	4,860	180		240	360	5,580	45,611
14	10,800	532.8	5,520	240		300	360	6,420	75,373
15 Sun.									
16	*12,000	547.2	6,960	240		360	480	8,040	43,183
17	9,600	504.0	5,760	180		240	300	6,480	39,247
18	8,400	532.8	3,360	300		300	300	4,260	41,371
19	8,400	589.6	4,320	240	120	180	240	4,980	38,056
20	9,600	518.4	5,280	240		360	360	6,360	45,145
21	9,600	532.8	5,280	240		240	300	6,060	76,364
22 Sun.									
23	*13,200	504.0	6,720	300		240	420	7,680	43,472
24	8,400	475.2	4,560	240		300	300	5,400	36,210
25	8,400	475.2	4,320	240		240	360	5,160	38,925
26	8,400	475.2	4,320	180		180	300	4,980	37,853
27	8,400	504.0	5,280	240		300	360	6,180	46,682
28	10,800	518.4	5,760	240	180	180	420	6,780	76,242
29 Sun.									
30	*13,200	547.2	6,720	360	60	420	360	7,920	43,982
31	8,400	504.0	4,560	240	60	180	360	5,400	40,161
Aug. 1	8,400	475.2	4,800	300		180	300	5,580	42,150
2	9,600	489.6	4,800	240		240	360	5,640	42,136
3	9,600	504.0	5,520	240	300	240	300	6,600	51,184
4	9,600	576.0	5,280	240	60	300	360	6,240	76,532
5 Sun.									
6	*14,400	532.8	7,440	420		420	420	8,700	39,435
7	8,400	532.8	4,560	240		180	360	5,340	40,708
8	9,600	489.6	4,800	300		300	360	5,760	40,581
9	8,400	504.0	4,800	240		180	300	5,520	43,053
10	9,600	518.4	5,520	180		240	300	6,240	57,665
11									78,474
Totals	252,000	Max. 604.8	135,660	6,540	840	6,720	9,000	158,760	1,399,682

* Two-day readings.

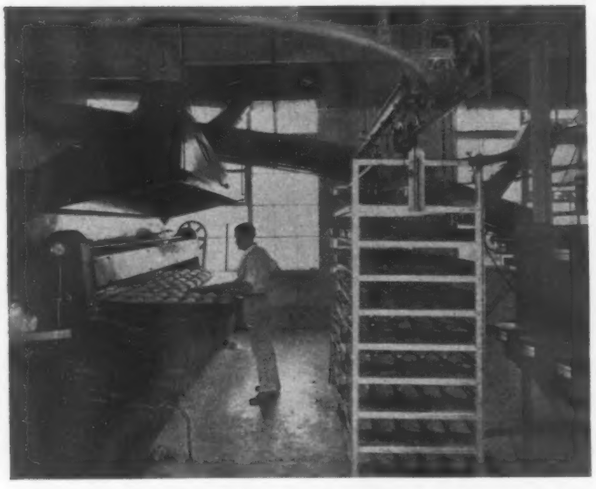
Estimated transformer losses at 38.9-per-cent load = 4,228.5 kw.-hr.
Transformer capacity kw.-hr. 30 days = 648,000.
Connected load kw.-hr. 30 days = 842,760.
Total load registered kw.-hr. 30 days = 252,000 = 38.9 per cent of transformer capacity.
Maximum demand 604.8 kw. Average demand = 350 kw.
Total oven load kw.-hr. 30 days = 158,700.
Estimated power and light load 30 days, 93,300 kw.-hr.

63 per cent of load is in ovens.
85.5 per cent consumed by Baker-Perkins oven.
4.7 per cent consumed by Ross ovens (70 kw. each).
9.8 per cent consumed by Rainier ovens (50 kw. each).
Use of power in bread ovens: 97 kw.-hr. per 1,000 lb. of bread.
Use of power in pastry ovens: 23,100 kw.-hr.
Approved by W. G. Knight, superintendent of meter and transformer department, Great Western Power Company.
Data from production sheets of Mutual company.

becomes thoroughly dry and the sequence of operation is worked out more carefully. The regular P-1 schedule of the power company applies. There is some question as to the proper rate earned by the oven due to the sliding scale of the power rate and the large number of motors installed. Approximate figures chargeable to the oven seem to be 1 cent per kw.-hr. Without the traveling oven the rate for pastry ovens alone and motor load would be a little over 2 cents.

From the record of the 30-day test (Table 1), it will be seen that the maximum demand was reached during the earlier period of the test. The figure of 604.8 kw. was never reached again after the first three days, not even on Aug. 3 when all ovens, including the one usually kept for spare, were operating.

The Mutual Stores, Inc., operating analysis, and more particularly its reasons for preferring full electric operation, should give impetus to the electrical baking theory.



Loading end of the traveling oven. Monorail conveyor system feeds the supply. Note control panel position at extreme right.

TABLE II—Pastry Baked—4 Ovens

Description	*No. of Pieces*
Pumpernickle	6,163
Sweet buns	Doz. 3,684
Finger buns	Doz. 5,249
Parker house	Doz. 4,843
Cinnamon rolls	Doz. 2,962
Poppy seed	Doz. 40
Snails	61,365
Butterhorns	76,032
Bear claws	16,458
Wreaths	4,371
Danish pastry	5c 32,408
Danish pastry	25c 84
Fruit squares	355
Steven squares	23
Cinnamon squares	87
Jelly squares	1,781
Butter squares	81
Rings	2,286
Jelly rolls	2,371
Chocolate rolls	2,251
Angel rolls	2,795
Muffins	260
Steven rolls	595
Loaf cake	Small 3,094
Loaf cake	Large 8,759
Sponge cake	1,053
Sheet cake	876
Mutual strips	1,127
Mutual wraps	1,656
Alma fruit	800
Turnovers	7,750
Cup cakes	Spice 5,257
2 layer sq., 6-in.	5,710
2 layer sq., 7-in.	1,820
2 layer sq., 8-in.	210
2 layer rnd., 7-in.	3,011
2 layer rnd., 8-in.	6,445
2 layer rnd., 8-in.	Dec. 2,572
2 layer rnd., 9-in.	23
Special layers	11,413
Total pieces	288,120
Use of power in pastry ovens	23,100 kw.-hr.

Forecasting Annual Runoff

in the Klamath Basin

By John F. Partridge

ENGINEERING studies for the purpose of preparing forecasts of the runoff to be expected seasonally from a given drainage basin have, of recent years, been the subject of a recreated interest. This interest, perhaps, has been conspicuously confined to the Western states where water for irrigation or power development is the backbone of many communities and a gage to their future progress. Prediction studies pertaining particularly to minimum flow during the late summer and fall months attract the chief attention. In the Eastern and Middle Western states the prediction of flood flow is of equal or greater importance, but studies for flood predictions are of a different nature. Minimum-flow studies are the chief object of this discussion. Some of the first work in this line was undertaken in 1913 by the United States Weather Bureau in the Wasatch Mountains of Utah. (*Engineering News*, May 29, 1913.) Snow surveys formed the basis of that work. J. E. Church, Jr., of the staff of the Mount Rose Observatory of the University of Nevada, was perhaps a pioneer in this line. Mr. Church undertook snow surveys, as a basis for the prediction of summer runoff, as early as 1909. (*Engineering News-Record*, April 17, 1915.) These surveys have been continued with great success down to the present time. Their practical value has justified the effort.

IN THESE Western states where water for irrigation and power development is the backbone of many communities, the forecasting of water supply is highly important. In this article the author discusses the method followed in forecasting seasonal runoff in the territory of The California Oregon Power Company.

Property owners bordering Lake Tahoe have been given assurance that their lands will not be flooded, since excess water can be released in time to prevent an excessive rise in lake-surface elevation. Power companies have been able better to care for their power contracts, and ranchers, knowing that their water supply would be not less than certain stated percentages above or below normal, have been able to keep acreage seeded within economic limits, based upon the water expected.

In Utah the success surrounding the forecast has encouraged many towns and farming communities as well as irrigation, water and power companies to undertake similar programs.

California has water problems peculiar to herself. As in most Western states, the winter months comprise a wet season, the summer months a dry season. The winter snows in the mountains form a natural means of storage and added thereto are the storage reservoirs constructed to catch the heavy spring runoff. In larger and larger proportions the water supply available for irrigation and power development is being increased during those months deficient in rainfall and runoff. Here again prediction studies have received hearty support, and every effort has been made to seek out and to catalog the known and unknown in regard to the peculiarities of the relationships between precipitation and runoff in every major drainage basin.

The subject has been found of no less importance in southern Oregon. There the activities of The California Oregon Power Company in this direction have proved of inestimable value to that company and its success has been so pronounced that the Reclamation Service, individual water companies and irrigation districts have been glad to avail themselves of the results.

A discussion of the foundation for and the method of forecasting seasonal runoff as practised by the above company in its territory, is the object of this paper. It is hoped thereby that a picture of the practical application of such studies will be presented.

The data necessary for the ideal preparation of a forecast of available water supply should include the following:

1. Knowledge of the general topography, geology and hydrology of the drainage basins.
2. A continuous record of precipitation.
3. A continuous record of measured runoff.
4. A continuous record of measured snow depth or a snow survey.
5. Temperature records and evaporation records.
6. Record of irrigation demands, general business conditions, phenological data on plant growth, etc.

The study of the assembled data includes the preparation of the following:

1. A classification of the drainage basin as to the type of runoff.
2. Seasonal distribution, by months, of the normal precipitation.
3. Seasonal distribution, by months, of the normal runoff.
4. Qualitative analysis of precipitation to date (current year).
5. Qualitative analysis of runoff to date (current year).
6. Qualitative analysis of snowfall, temperature and evaporation.
7. "Trend of wetness" over territory under consideration.
8. Qualitative analysis of irrigation demands, general business conditions, phenological data, etc.

The forecast then includes the determination of the following:

1. Probable "Index of Seasonal Wetness" (i.e. percentage of normal precipitation).
2. Probable "Index of Seasonal Runoff" (i.e. percentage of normal runoff).
3. Probable distribution, by months, of seasonal runoff.
4. Quantitative forecast of probable inflow to storage reservoirs.
5. Quantitative forecast of probable irrigation demands.
6. Quantitative forecast of probable supply available for power.

* From 1920 until June of the present year Mr. Partridge was engaged in engineering work for The California Oregon Power Company at Medford, Ore.

Knowledge of the general topography, geology and hydrology of the drainage basin is fundamental. A forecast is an interpretation of the natural phenomena of the region, and before attempting an interpretation the country must be known and understood.

Records of precipitation, runoff and measured snow depth, temperature and evaporation, may be available at various stations through the U. S. Weather Bureau, or the U. S. Geological Survey. These are often quite complete for well settled areas, but for the unsettled areas are often sadly deficient. Individual effort for the establishment of recording stations in most advantageous locations is the only resort in the latter case. In California there are many well located stations for the observation of both rainfall and runoff. In southern Oregon there are but few. The selection of the proper location, or locations, representative of the drainage area is all important.

In considering the relative merits of measured runoff and measured precipitation (including snow surveys) as a criterion of probable water available, without question every engineer would favor the more positive record of measured runoff. The first step, therefore, should be the establishment of the runoff station. The record of measured runoff, however, generally is too late for the purpose of preparing a forecast. Precipitation in the form of rain or snow precedes runoff and is of more importance in forecasting. The rainfall record is obtained more easily than the record from snow surveys. Rainfall generally is widespread over a greater area than snowfall which is confined to the higher mountains and is difficult to reach in the winter and early spring. The station for the measurement of precipitation must be established, therefore, with the runoff station.

The relationship between runoff and precipitation must be established. Every locality often is peculiar unto itself. Northern California and southern Oregon, perhaps, are fortunate in finding these relationships fairly well established.

Snow surveys are a more recent contribution to the science of hydrology. They are of two kinds: (1) the measurement of total snowfall, unmelted depth on ground and density thereof at fixed stations or snow stakes; (2) the measurement of unmelted depth and the density thereof over fixed courses so that average conditions are represented. Of the two the latter is preferable though excellent comparative results have been effected through the former method. The interpretation of the data from snow surveys can also be used in two ways: (1) for a quantitative analysis, in which the expected runoff is given in acre feet; (2) for a qualitative analysis, in which the comparative snow depth and comparative density is used to define the type of season expected and the runoff expected given as a percentage of normal runoff. Each method perhaps would have its preference in different cases. The quantitative analysis would require a longer record and a more extensive survey of the watershed and would therefore be more expensive to maintain. A qualitative analysis merely adds valuable data for the interpretation of the rainfall record and one or two stations on the watershed may suffice. Also the apparatus for a qualitative analysis may be of the simplest kind and therefore inexpensive.

The temperature and evaporation record is used as an aid in establishing the probable seasonal distribution of the expected runoff. Phenological observations of the growth of plant life and movements of animal life are of use in interpreting the more positive data. General business conditions, irrigation demands and similar information are for the purpose of fixing the probable depletion of the expected runoff for purposes other than the uses to which the organization interested in the forecast intends to apply the water available.

In the preparation of assembled data, use was made of methods presented by C. E. Grunsky in rainfall and runoff studies in California. (Transactions A.S.C.E., Vol. LXXXV, 1922, page 66.) Monthly precipitation in inches and runoff in acre-feet is converted to a percentage of the normal annual.

Seasonal distribution is presented in a mass curve of the accumulated percentages of normal for each month of the season. The mass curve of seasonal distribution for a normal year (either of rainfall or runoff) would show a total of 100 per cent for the season. The mass curve for years other than normal show an accumulative total of percentages for each month above or below 100 per cent. The last are the "indices of wetness" in the case of precipitation and the "indices of runoff" in the case of runoff. The indices of wetness (rainfall) and runoff indicate the departure from normal for the season.

Thus converted to the common denominator of "percentage," direct comparisons are easier and the relationship between rainfall and runoff can be established.

The "trend of wetness' is found by obtaining the algebraic sum of the departures from normal. The departure from normal is the percentage above or below normal. Plotted as a mass curve with the year of record as abscissa, a rise of the graph indicates a wet period, a drop in the graph a dry period. Consecutive dry seasons may tend to reduce minimum low water flows.

Each month records are reduced to percentages of normal and plotted as an addition to the mass curve representing the accumulative total to that date. Then compared with the plotted results for previous years, the qualitative analysis of the season's rainfall or runoff is made possible. If the record from snow surveys is of sufficient duration the same analysis may be applied thereto. In the case of snow data, if the depth in inches remaining on the ground at any station, say on the fifteenth and the thirtieth of each month, be plotted as ordinates, the area under the curve (in percentage of area under curve for normal year) will afford a unit of comparative measurement satisfactory for the purpose. The slope of the mass curve of seasonal distribution of runoff at any point indicates the rate of runoff for that month and will be found of value in fixing the extent of flood flows. A similar method of percentages is used in a study of irrigation requirements or other seasonal use of water.

The qualitative analysis results in the determination of the index of runoff. The normal runoff for the basin being known, the probable runoff in acre-feet is known. It should be noted herewith that in this qualitative analysis the actual precipitation at the rainfall station may bear any quantitative relationship whatsoever with the measured runoff. The measured rainfall may represent the average rainfall over the basin in question or it may be greatly in excess thereof or greatly less. The runoff station preferably should be located close to the point of use while the rainfall station is selected for the similarity between the variation from normal of its record and that of the runoff station.

The system of The California Oregon Power Company comprises both stream-run plants and plants operated by water from storage. In connection with the release of water from storage an early need was developed for the forecast of the probable low-water flow. In the upper Klamath basin the Reclamation Service developed the Klamath Irrigation Project and after the extreme dry season of 1923-24 a co-operative effort between the

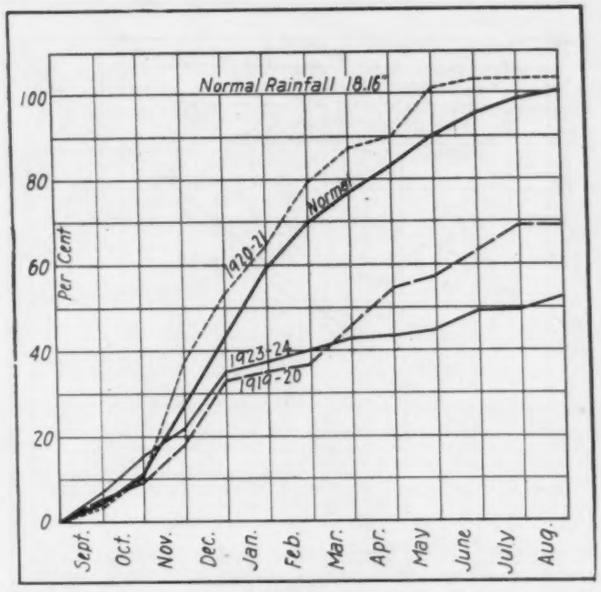


Fig. 1. Seasonal distribution of precipitation at Chiloquin, Ore., part of the Klamath River runoff study.

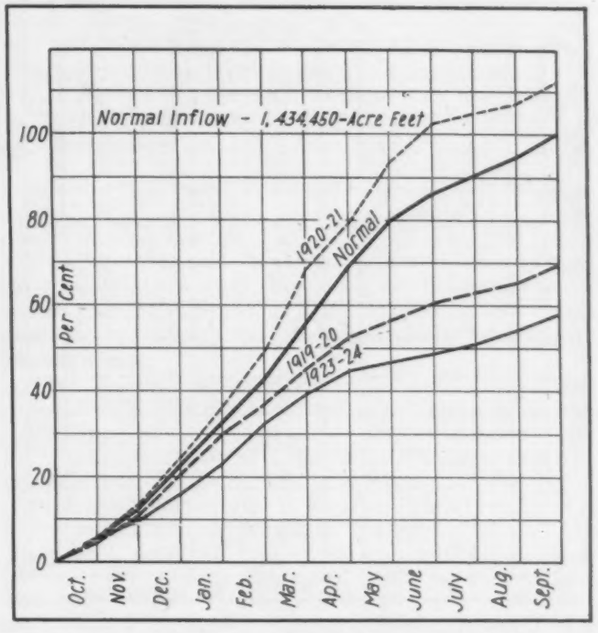


Fig. 2. Seasonal distribution of inflow to Upper Klamath Lake, part of the Klamath River runoff study.

Reclamation Service and the power company resulted in seasonal prediction studies undertaken as part of the regular routine of operating. These studies follow closely the outline prepared above.

A classification of the drainage basins of California and Oregon as to type of runoff brings out the natural features of these regions. The territory in which The California Oregon Power Company is interested is of igneous origin, instrusive and volcanic. From the Feather River north to the Columbia are found, strata above strata, intrusive and volcanic rock covered as with a blanket by volcanic debris and pumice dust. The ensemble is a vast sponge capable of absorbing the greater part of all the precipitation thereon, whether rainfall or melted snow. This forms a natural reservoir and minimum stream flow is held to high levels and is generally found to be fairly constant. Only a continued series of consecutive dry years seriously depletes this spring flow.

South of the Feather River, in California, the granite country is found. There the natural ground reservoir condition is absent. Spring runoff is rapid and complete, leaving only the slower melting snow fields to maintain the minimum summer flow. Natural reservoir sites however are more numerous than in the porous Cascade country to the north and these, when developed, conserve the spring runoff.

North of the Columbia River are found the conditions prevalent in the Cascades with the added increment of glacier flow fed from the higher mountains.

The principal rivers in southern Oregon are the Klamath, Rogue and Umpqua. The Klamath River with headwaters on the eastern slopes of the Cascades has characteristics differing somewhat from those of the Rogue and Umpqua which arise on the western slopes. Below the headwaters of the Kalmath, but still at El. 4,100, lies Upper Klamath Lake, a body of water 35 miles long with a surface area of from 60,000 to 90,000 acres. This lake acts as a regulating reservoir though its capacity is less than that required to regulate completely the annual discharge. A dam erected across its lower end permits of this regulation to the fullest extent possible. The Rogue and Umpqua lack the natural storage facilities of the Klamath. The north fork of the Umpqua has greater economic importance than the South Umpqua as it reaches back to the porous country previously described. The South Umpqua has its headwaters westward from the divide and its stream flow consequently assumes more of the characteristics peculiar to streams south of the Feather River.

A continuous record of runoff in the upper Klamath basin was established by the Reclamation Service in 1904 and rainfall records were started by the Weather Bureau as early as 1884. For a number of years the precipitation record at Klamath Falls was used in all water supply studies. After an analysis of all available records by the methods described above for the assembly of data, the record at Klamath Falls was discarded for the Chiloquin record because of the closer agreement between variations from normal for runoff from the basin and rainfall at the latter station.

The rainfall at Klamath Falls is erratic in its seasonal distribution as is common with precipitation in desert and semi-desert areas. Chiloquin, at approximately the same elevation and only 40 miles to the north, is in a heavily timbered area of rolling mountains of uniform height and with few high peaks. Storms in that area are uniformly distributed in extent and intensity. Chiloquin is situated at the confluence of two of the most important tributaries draining 2,900 sq. miles of the 3,500 sq. miles in the basin. All of this runoff passes through the regulating basin in Upper Klamath Lake. Runoff is measured by inflow to the lake. Inflow is determined from the measured outflow and the recorded rise and fall in the water surface of the lake. Evaporation by this means is compensated for. Snow surveys have been undertaken only recently. With the growth of the power system and increased development on the other streams of the territory, rainfall and runoff studies have been extended to the Rogue and Umpqua River basins. The State of Oregon is now seriously considering the extension of snow surveys to other drainage basins in the state where irrigation has reached a high stage of development.

In the basin of the Upper Klamath the seasonal distribution of rainfall at Chiloquin and of inflow to Upper Klamath Lake (runoff from the basin) has been prepared for each year of the record. Figs. 1 and 2

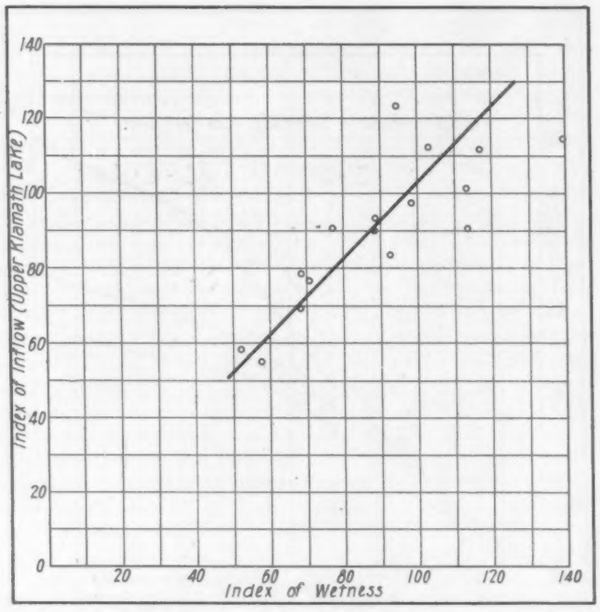


Fig. 3. Relation between "indices of rainfall" and runoff in the basin of Upper Klamath Lake. Rainfall data from the station at Chiloquin, Ore., and inflow data from lake level measurements and measured outflow.

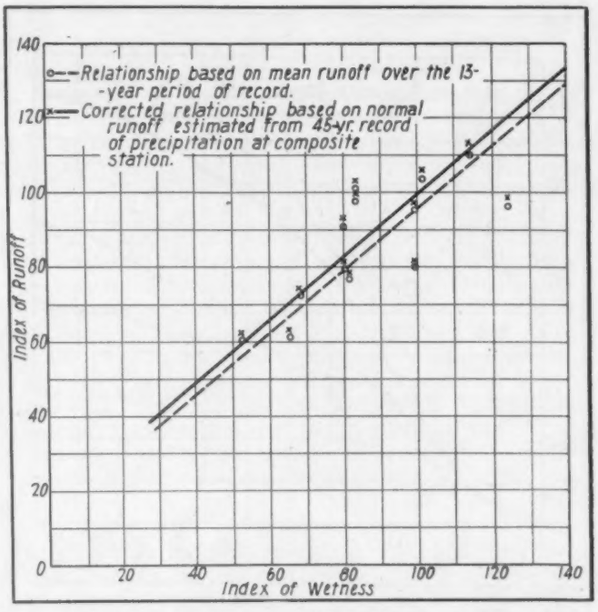


Fig. 4. Relation between "indices of rainfall" and runoff in the upper basin of the Rogue River (Ore.). Composite rainfall data from four stations and runoff measured on North Fork below Prospect.

illustrate rainfall and runoff respectively for years of different degrees of wetness. The indices of wetness and runoff are as follows:

Year	Index of Wetness (Per cent)	Index of Runoff (Per cent)
Normal	100	100
1920-21	103	112
1919-20	69	70
1923-24	52	58

It should be noted that the rainfall year starts Sept. 1 and continues until Aug. 31, while the runoff record lags by one month, covering the period Oct. 1 to Sept. 30. This is for the reason that the runoff during October is directly affected by the rainfall in September by reason of the direct runoff and is indirectly affected by the influence of the rainfall upon irrigation, evaporation, etc.

The relationship between rainfall and runoff in the upper Klamath basin is shown in Fig. 3, while Fig. 4 gives the relationship in the basin of the upper Rogue. In all but very dry years it is generally somewhat wetter in the Rogue than in the Klamath. In dry years, however, the low water flow in the Rogue holds up better than does low water flow in the Klamath. This is to be expected as a large percentage of the tributaries of the upper Rogue are spring fed. In preparing Fig. 4 consideration was given to the fact that the runoff record extended over the short period of thirteen years during which rainfall was only 87 per cent of normal. Normal runoff would be the mean over a period during which rainfall was normal.

The qualitative analysis for the year 1928 had been completed to June 1, at the date of this writing, as shown in Fig. 5. On Jan. 1 it was observed that precipitation was below normal, the curve of seasonal distribution following closely that for the year 1921-22. Apparently a year only 10 per cent below normal might be expected. Below-normal rainfall in February with the curve following the year 1922-23 more closely made it appear on March 1 as if a year only 75 per cent of normal would be more nearly correct. The snow surveys showed that snow depth was below normal but practically as great as that of the previous year which was a year of normal runoff. The fall rains of the previous year had been exceptionally heavy, however, and may have made up for the deficient snow depth. The snow surveys have not been established a sufficient number of years to permit a close analysis, but the February (1928) survey showed as wide a distribution as the previous year and a greater density of pack. Temperatures were normal and nothing could be told therefrom. The depth and density of the snow pack,

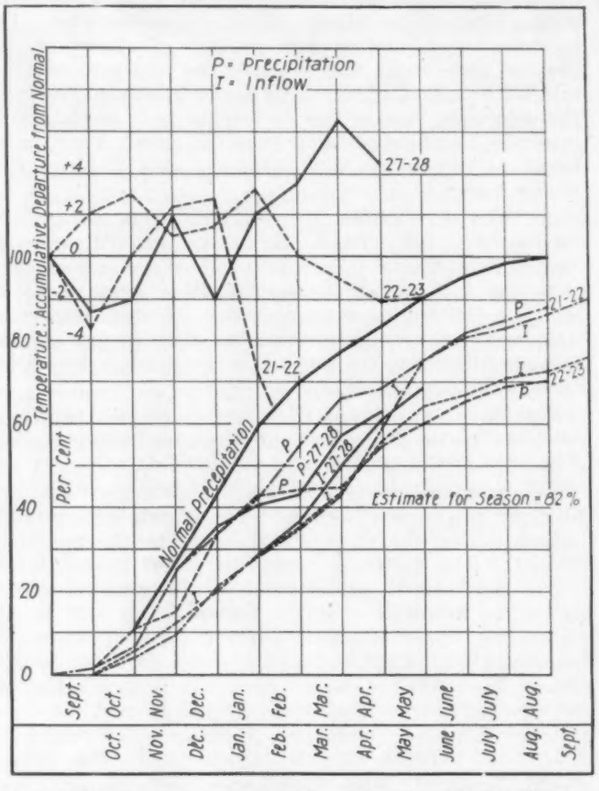


Fig. 5. Klamath River runoff study giving forecast for the year 1927-28, a qualitative analysis for the determination of "indices of wetness" and runoff.

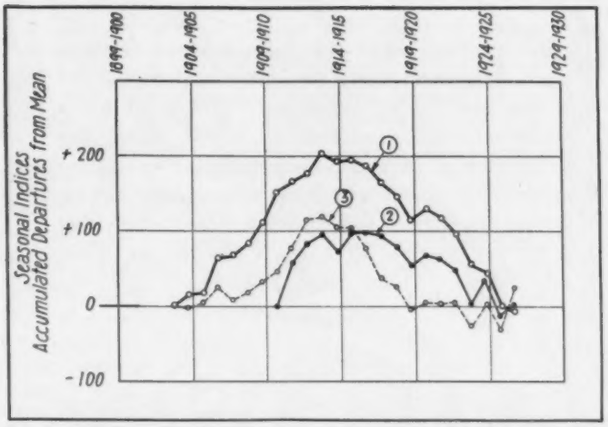


Fig. 6. Inflow to Upper Kalmath Lake and precipitation in the lake area. Curve 1 shows inflow to lake, each annual period extending from Oct. 1 to Sept. 30. Curve 2 shows precipitation at Chiloquin, Ore., annual periods from Sept. 1 to Aug. 31. Curve 3 shows precipitation at Klamath Falls, Ore., annual periods from Sept. 1 to Aug. 31.

however, indicated that a year better than only 75 per cent of normal might be expected. The precipitation record and the record of inflow to Upper Klamath Lake for March, April and May bore this out and the indications on June 1 were for a year between 80 and 85 per cent of normal.

The curves indicating "trend of wetness," Figs. 6 and 7, are somewhat disconcerting at this time, the proper interpretation being unknown. Perhaps the critical point was reached with 1923-24 or 1925-26 and the trend again will be upward. On the other hand, perhaps the minimum still is to be reached. Between the two minimum years was a year of normal characteristics and the uncertainty lies in whether or not a repetition should be expected. The general unsettled weather conditions prevailing as contrasted with conditions prevailing in the previous dry seasons and the more satisfactory depth of snow in the hills influenced the acceptance of 82 per cent as the wetness characteristic for the 1928 season. It was expected, however, that irrigation demands would be early and probably very heavy during the first and third irrigations.

The indices of rainfall and runoff in the Klamath and Rogue River basins taken from Figs. 3 and 4, are as follows:

	1928 Percentage of Normal	
	Rainfall	Runoff
Klamath basin	82	85
Basin of the upper Rogue	87	90

In the Klamath basin, therefore, the prediction is for runoff approximately 85 per cent of normal and in the basin of the upper Rogue approximately 90 per cent normal runoff.

Some interesting comparisons in precipitation and runoff for various drainage basins are given in Fig. 6.

In Fig. 6 are presented the 23-year records 1904-1927, covering inflow to Upper Klamath Lake, and precipitation at Klamath Falls and Chiloquin, Ore. The similarity of the records at the two rainfall stations is well shown. The first half of the period is wet, the latter half dry. Of the two records, the record at Chiloquin more nearly parallels the graph of inflow. The proportional relation between the rainfall and inflow is the basis for the forecast studies discussed herein.

When arrangements have been made to obtain reports from observers promptly each month, and studies such as described above are regularly made, it is possible to follow the season closely and to anticipate the conditions to be experienced the following summer. The success of the forecast will depend upon the fairness of the record and the completeness of the interpretation thereof. A good runoff record is fundamental and a proper selection of the rainfall station equally as important. The success experienced through the use of these methods and the simplicity of the analysis should encourage their use and result in equal success elsewhere.

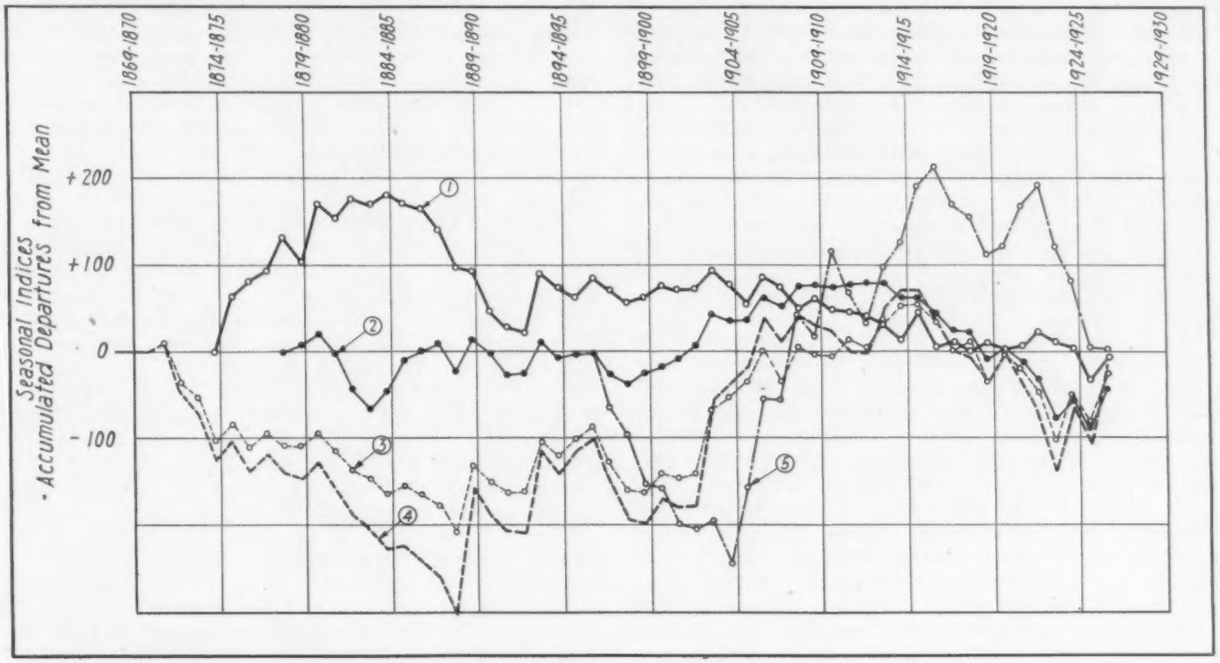


Fig. 7. Trend of wetness for southern Oregon and northern California area. Curve 1 shows precipitation at The Dalles, Ore., annual periods from Oct. 1 to Sept. 30. Curve 2 shows composite precipitation recorded in upper Rogue River basin stations, annual periods from Sept. 1 to Aug. 31. Curve 3 same as Curve 2 for Klamath-Trinity area, annual periods from July 1 to June 30. Curve 4 shows the runoff of the Shasta River from the Klamath-Trinity area. Curve 5 shows snow on the ground at Summit, Calif., in the upper American River basin of the Sierra Nevada range.

Business *and the Rising Tide of* Taxation

By Rolland A. Vandegrift
Director of Research, California Taxpayers' Association.

ONE-SIXTH of all national income goes directly or indirectly to pay for the cost of government. For most businesses the tax bill is more than the amount earned for dividends. The author believes that the subject of taxation is one that deserves the same careful study by business men that they devote to their own expenditures.

THE QUESTION of taxation has become the most pressing economic problem of our country today. Taxes are a compelling factor in private business, and in this period which can so aptly be termed one of "profitless prosperity," they are often the margin between profit and loss. We have maximums in stock market transactions, post office receipts, bank clearings, building permits, and in general business done, and yet smaller profits, if any at all, by private businesses than in former years. We have also maximums in governmental expenditures and bond issues calling for future tax bills.

Public finance is playing a controlling role in national prosperity and in the cost of living. It is imperative that business men examine into the tax problem before it is too late to realize that in fact "the power to tax is the power to destroy." It is imperative that we not only examine how public funds are raised, the purpose for which they are raised and how they are expended, but we must develop a national "economy-mindedness" which will demand capable management of public finance and a dollar's return for each dollar of tax revenue spent. The objective must be to eliminate waste and to effect sensible economies consistent with progressive and satisfactory governmental service. The only way to secure these desirable objectives is through eternal vigilance and constant and active participation of the capable business executives of this country in the affairs of government, for in a republic we get just the kind of government we deserve.

The Business Executive Challenged

The business executive does not need to become an office holder to participate in government, but he can know his government and see that affairs are conducted on good business principles. The task is no easy one but is of such magnitude as to challenge the best brains of private business. Today the business of government is the third largest business in the United States, exceeded in its annual turnover only by the manufacturing industry and agriculture. This business of providing public services is no less important than private business for the security, welfare and happiness of the people, but it differs in one significant respect,—it is my nature everybody's business and has more and more, as our society has grown complex, become nobody's business.

The collective thought and energy of the community devoted to the business of government is far less than that given to the supervision of other businesses of much less size and importance. Yet the community pays the tax bill for government. The responsibility falls upon the community to devote as much thought and energy to making the business of government efficient and economical, to reducing the cost and improving the quality and quantity of the services the taxpayer pays for, as has been applied to industry and trade to give the customers better products and services at lower prices.

Business men, as a group, give far less thought and energy to expenditures of their money which make up the tax bill than to disbursements which they control directly in their business. Yet the tax bill is generally the greatest single overhead charge in the cost of doing business. Until very recently the best business executives have devoted every energy to reducing financing costs, production and operation charges—including their own visible taxes—and sales costs. But they have paid the tax bills grumblingly and have made little or no effort to see that costs for government were reduced to the minimum by the same good business methods they have striven so hard to maintain so they could pay the tax bills. Seldom has it been realized that if the same energy had been devoted to controlling expenditures of tax money as to controlling business expenditures, similar results could have been secured.

If watching taxes helped business, the business executive would devote more of his time to seeing that tax money is really needed and is properly spent. Thus he would be serving his business better than neglecting entirely this matter, and his business probably could pay more in dividends. The probabilities of securing this result are evident from the fact that approximately one-sixth of our national income in 1928 goes directly and indirectly to pay for government. It was estimated that in 1925 about one-eighth of our national income went directly to support government activities as compared with one-sixteenth before the war. The business man thinks that he works for his wife and family, but in fact he works, on the average, one-sixth of his time for the tax collector. Think of it—one-sixth of all labor, one-sixth of all the floor space in every office building, every sixth sack or bushel of wheat produced by the farmer, every sixth automobile (and judged by the number used by officials, even more), every sixth kilowatt-hour of electric energy, every sixth fruit tree, every sixth unit of all that is sold or used to produce income goes annually to pay for government expenditures. In some businesses the percentage is even far more. It is estimated that every twelfth person is supported by the tax payers.

For many corporations taxes have come to be larger than dividends. The Bureau of Internal Revenue figures

for 1924 (the last year available) showed that all corporations filing income tax returns paid 30 cents in taxes for each dollar paid in dividends. This does not take into consideration the large number of corporations that had no net income upon which to pay taxes, nor does it indicate that there are entire lines of industry paying more in taxes than in dividends. The stockholders are interested in dividends, and when taxes cut into dividends they have a right to be interested in taxes on their corporations and to ask their executives to be interested in the tax bills which cut down dividends. This is increasingly important when so many people are becoming stockholders in industry.

Federal taxation, of course, was increased tremendously during the war so that at the close of the war, out of each dollar collected in the United States the federal government took 60 cents and local government 40 cents. While we were in the war the federal government expended money at the rate of a mililon dollars per hour, and the tax bill and the national debt increased accordingly. The national debt at the beginning of the war was but one billion dollars, but on June 30, 1919, it was more than twenty-five billion dollars. Since the war the federal government has reduced taxes as far as prudence will permit. It has set a splendid example, not only for the other nations of the world, but for state and local units of government within our own country.

Save at Washington and Waste in the States

While the federal government through strict economy, a well controlled budget and reduction of interest requirements has been reducing taxes, local, state county, municipal and school districts have indulged in an orgy of spending the taxpayers' money. They have not only spent all that has been saved by the federal government, but even more. What has been saved at Washington has been spent in the states, and on top of this, for every billion dollars saved at Washington two million has been expended by the local governments. By 1925 local governments were responsible for 52.6 per cent of the annual public expenditures and by 1928 the percentages of total expenditures at the end of the war had more than been reversed and the federal government was only responsible for 37 cents in place of 60 out of each tax dollar collected, and local government was responsible for 63 cents.

No longer can the high cost of living be attributed to federal taxes, but in so far as the tax burden is concerned the greater burden must be charged to the state and local units of government. At the present time the first nineteen million dollars earned each working day by the farmer, by the factory worker, in the office, in the mines, by our ships and in our markets throughout the United States, are encumbered before they are earned for expenditure by local units of government other than state and federal. In addition to this, almost an equal amount is required by state and federal government. The total amount of all taxes collected by federal, state and local governments for the fiscal year 1926 was $8,499,000,000. This was an increase of $608,000,000 over the 1925 figure. The total expenditures of these units of government, however, were $11,124,000,000. This means that in 1926 government in our country spent three billion dollars more than was collected in taxes.

A large part of this excess expenditure over taxes represented borrowing by bond issues. These issues of tax exempt securities by local government are averaging $1,300,000,000 annually. Only one state, Massachusetts, is consistently paying as it goes, and less than twenty of the states are spending within the limits of their annual revenue. The tremendous outstanding bonded indebtedness of our government predestines our future generations to the burden of high taxes. Our habit of installment buying by government through bond issues has caused us to charge to our grandchildren all kinds and classes of governmental expenditures from the most necessary to the most fancy frills ever conceived by the most visionary student of government. Tax exempt securities of local governments are now more than fifteen billion dollars. The interest bill for local indebtedness is constantly increasing, while that of the national government has been reduced. The national government reduced its interest payments from $1,056,000,000 in 1923 to $831,619,000 in 1926. The national debt has been reduced from $25,482,000,000 in 1919 to $18,512,000,000 in 1927. State and local indebtedness, on the other hand, increased from $3,364,000,000 in 1913 to $11,703,000,000 in 1927.

Expenditures annually for and by American government are equal to half of our savings-bank deposits. The public exchequer annually expends a sum greater than the value of the crops raised on seven million American farms utilizing approximately 400,000,000 acres of land. The annual value of our foodstuffs and cotton will not meet the revenue requirements of our municipalities. We must add to this the value of all our wheat for the state expenditures. Neither the net income of the manufacturing corporation nor all the money in circulation in the nation is sufficient to meet the combined annual expenditures of state and local government.

The Burden of Local Taxes on the Income of Corporations

Since the close of the World War taxes for the support of local units of government have been a heavy burden on the income of all classes of property. The income of corporations has been materially reduced by the local tax bill. As has been pointed out, corporations paid in 1924 an average of 30 cents in taxes for each dollar paid in dividends to stockholders.

Out of this 30-cent tax charge, state and local units of government took approximately 19 cents. The ratio of local taxes to net earnings ranged from 9.11 per cent for companies engaged in construction to 104.55 per cent for mining and quarrying concerns. The several corporations listed in classified groups showed the following ratios of taxes to net profits:

	Per cent
Construction	9.11
Manufacturing	13.40
Trade	15.23
Finance, banking and insurance	21.37
Transportation	23.54
Agricultural	69.06
Mining and quarrying	104.55

To these figures should be added federal taxes which, until the recent tax reduction schedule of 1928, have taken 13½ per cent of net income as a federal income tax. These figures, moreover, do not show the fact that within the general classifications many individual corporations and even entire branches of industry are paying far more in taxes to all divisions of government than they are paying in dividends to their stockholders.

The general situation may well be illustrated by the condition of the railroads. From reports of the Interstate Commerce Commission the following figures are taken. The cash dividends and the total taxes paid for selected years from 1913 to 1927 are indicated:

Date	Cash Dividends	Taxes Paid
1913	$322,300,405	$118,386,859
1916	306,176,937	157,113,372
1919	278,516,908	232,601,396
1922	271,573,751	301,034,923
1925	342,020,885	358,516,046
1927	460,845,844	375,097,875

The apparent relative decrease in taxes for 1927 in comparison with dividends is due to the increase in earnings and dividends, as taxes actually increased.

The burden on net incomes for state and local taxes on classified industries can be illustrated by taking the case of the state of Wisconsin. The following table, which represents a four-year average showing the percentages of the net income absorbed for state and local taxes, was compiled by Wisconsin experts:

	Per cent
Municipally owned utilities	6.03
Unincorporated business (individuals, firms and partnerships)	7.1
State banks and trust companies	12.5
Electric railways	16.9
Manufacturing corporations	15.7
Mercantile corporations	19.6
Miscellaneous business corporations	22.1
Average all business corporations	17.2
Public utilities, locally assessed	14.6
Public utilities, assessed by state	19.5
Telephone companies	23.3
Steam railways	29.2
Farms	30.6

Business men find that in many instances they are merely tax collecting agents for the government. The balance sheet of corporation after corporation continues to show that practically as much or more is paid in taxes as is paid in dividends to the stockholders. It is estimated today that for every dollar paid in dividends approximately 62 cents is paid in direct taxes.

Tax Reduction Necessary

It is evident that our tax situation cries for remedy. It demands the best business leadership, unless we are willing to permit the rising tide of taxation to engulf our hard won surplus and to take from private administration the proceeds of labor and industry and give it over to be spent by government. And it will be spent without the benefit of business advice, which can be made available if business is prepared to tackle the task.

"We Have No Apologies to Make"

By Guy W. Talbot
President, Pacific Power & Light Company, Portland.

A frank statement regarding the investigation of the electric light and power industry in the Pacific Northwest by the Federal Trade Commission.

THE Federal Trade Commission's investigation of the publicity and educational practices of public utilities has now progressed until the practices of public utilities in the Pacific Northwest have undergone examination.

It is pertinent at this time to discuss this matter briefly for the information of employees who rightly have confidence in the integrity of the industry of which they are a part.

Let it be said first that much of the testimony already given has been subjected to malicious misrepresentation both in news reports and editorial comments by newspapers who either seek popularity through unfair attacks upon our industry or who are so thoroughly saturated with prejudice that they have neither the will nor the ability to be fair. Then there are those who declaim volubly and loudly from the public platform against our industry in self-seeking political exploitation or because of prejudice or ignorance. Then, again, there are those who are in league with well-organized and amply subsidized propagandists who are constantly working to build up a public sentiment favorable to government ownership, some of whom hope by the socialization of our industry to socialize all industry and thereby reach their objective of complete socialism.

Let it be said, secondly, that the hearings at Washington to date have been confined only to one side of the case. The industry has not yet given its own evidence or any evidence in refutation or explanation of what evidence has been given. The industry has been assured of an opportunity to present its own case to the commission. Fair-minded people will await a full presentation before they pass judgment.

It may be that some few among the many companies throughout the nation have been over-zealous in their publicity and educational practices in meeting the

unscrupulous and envious attacks of government ownership propagandists, but is it fair to condemn a whole industry because a few have unwisely committed indiscreet acts? Would you condemn Washington and all of his Continental army because one of them happened to be proved a traitor?

With these prefaced remarks, I will now confine my comments solely to the testimony recently given at Washington affecting our own activities here in the Pacific Northwest with reference to publicity practices and relations with educational institutions.

Industrial News Bureau

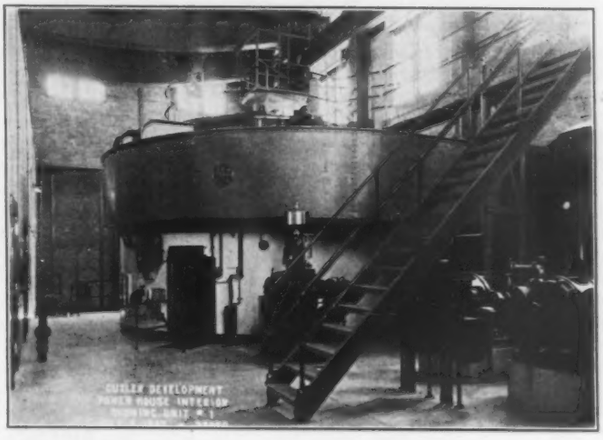
First, you have been regaled with glaring headlines about the industry's support of the so-called Hofer service or the Industrial News Bureau. This bureau is not a publicity agency of the public utility industry. It was not started on its way by the industry. It has never been the mouthpiece of the industry. It is a bureau also supported by other industries than the public utility industry. The bureau is conducted by men who believe in the economic progress of the nation and state through encouragement of private initiative and enterprise in the development of our national resources, establishment of industry and creation of payrolls. These men have provided a news and editorial service which newspapers are free to use or not to use. The service has a legitimate purpose and I have yet to learn of its news and editorial material being questioned as to its accuracy or integrity or of its finding subtle entry into the columns of any newspaper. The news material is used because of its news value. The editorial service when used is used presumably because it reflects the editor's point of view. No one affiliated with the Pacific Power and Light Company has attempted at any time or in any way to get any newspaper to make use of any of the service. I know of no other company which has done so. No editorial copy has ever been written or censored by anyone connected with the Pacific Power & Light Company, nor by any other company to my knowledge. In fact, I would challenge any editor in any of the territory wherein we operate to offer any evidence of our having either solicited or through unethical means sought his use of the service. Some newspapers with a liberal use of ink talk about all of the utility companies in the entire nation spending $84,000 a year toward the support of a bureau which costs money to maintain. Perhaps they do, but to the inquiring person each employee can say that the Pacific Power & Light Company spends $30 a month and that it proposes to continue to spend it so long as the bureau provides a service of unquestioned accuracy and integrity and with business practices which are at all times ethical.

The next order of testimony has been the educational monograph on the electric light and power industry in Oregon. This monograph is only one of two already prepared, the other covering the woolen industry, which were to be among other monographs dealing with basic Oregon industries to be used in the schools so that those seeking knowledge might know something of the facts about how these industries function and their relations with government. What has gone into the Oregon monograph regarding the electrical power industry has been educational and not argumentative. No attempt has been made to prove or disprove any political or economic theory. Again, I would challenge any educator or any government ownership advocate to disprove the facts set forth in the monograph or to sustain any evidence of its being propaganda in any sense. The young men and women ought to go out of our schools knowing something of the fundamental facts about our industry and other basic industries. The Pacific Power & Light Company of itself and in cooperation with others of its industry will do all it can legitimately to get a true presentation of facts so that students may know something about how our industry functions and the purpose it serves in the economic life of the state and nation. To this no expounder of any theory can take honest offense. If he does it is because he is fearful the facts may prove his theory to be unsound. The industry in the Northwest has no apology to make for any of its relations with educational institutions. It is not going to be influenced by abuse or misrepresentation to deviate from its purpose to at all times get the facts before anyone willing to listen, whether it be the man in the street or the boy and girl in the public schools.

Opposition to Housewives' Bill

The electrical companies in Oregon did spend money in the 1926 state election to defeat the so-called Housewives Bill providing for government ownership. These expenditures were made without any violation of the corrupt practices act and with the filing later of a detailed statement of receipts and expenditures with the Secretary of State. The money was legitimately and necessarily spent by these companies. They had a right to defend themselves against unfair competition and possible confiscation of property and security values. They had the same right as any other industry confronted by similar conditions to protect the many persons who hold investments in their property through bond and stock ownership, many located in Oregon who receive their interest and dividends here and who spend the proceeds here. In fact, they not only had the right to do this, but it was their duty to do it. They also had a right to protect their standards of service which might have been lessened under financial difficulties brought about by unfair competition. Furthermore, they had a right to protect the adequacy of their service which could not have been extended to meet new and increased demands because of their inability to attract capital when the reasonable security of it was jeopardized by possibilities of unfair competition and possible confiscation of property represented by lawful and legitimate investments.

In a Utah Plant



Interior of the Cutler hydro-electric plant of the Utah Power & Light Company showing the 18,750-kva. No. 1 generator and part of its auxiliaries.

Engineering Practice

Lightning Voltage as a Factor in System Design

Decentralized Arrester Installations, Elimination of Terminal Stations, Proper Line Location and Joint Design of System Insulation and Lightning Protection Are Important Modern Trends

By A. L. ATHERTON, Lightning Arrester Engineer, Westinghouse Electric & Manufacturing Company.

DURING the past year or two there has been developing a new understanding of the problems which lightning introduces in electrical system design and operation. This has found its most tangible expression in the increasing tendency to use lightning arresters on high-voltage stations, even up to 220 kv., and in the close attention being given the individual problems before the applications are made. These things together with other advances now being made in the art seem likely to have an appreciable effect upon lightning protection practice. A review seems worth while.

Interest in the problem of lightning protection has been growing steadily for the last several years. Prior to this time the industry as a whole was rather disinterested and looked upon the occasional interruptions to service caused by lightning as unavoidable, though seriously disturbing and expensive. Industrial development has created a market for electric power which requires continued expansion of electric generation and transmission facilities and which demands reliability of service.

Since service interruptions have become more and more intolerable they are therefore subject to ever closer analysis and where such analysis discloses a weakness no effective move appears to be too difficult or costly to be worth while. The situation has been further complicated by the growth of the interconnection idea, the tremendous benefits and economies of which can be secured only with reliability of transmission. If this reliability cannot be assured these gains turn into losses.

During the last few years the conviction has become more and more general that one of the serious barriers to accomplishing the necessary reliability of service is lightning. Thus there has grown up a diversified interest in the lightning problem far exceeding any earlier interest. The pressure for results no longer is applied only to small groups here and there that have specialized on the problem; it reaches nearly all the industry and it is inevitable that the added brain power on the job should bring an increase in progress.

The lightning problem consists broadly of three parts: the investigation of the lightning phenomena, the development of protective equipment, and the co-ordination of apparatus and line insulation with the protective equipment to meet the conditions. It requires the measurement of lightning voltages and analysis of results, laboratory determination of the performance characteristic of protective equipment, logical application of such equipment to the protection problems, and the observation and analysis of results secured. It requires further an exhaustive laboratory study of apparatus and line insulation from the standpoint of lightning voltages.

These activities are going on in parallel, progress is being made in each line, and an understanding of the problem as a co-ordinated whole is growing rapidly.

The Nature of Lightning Voltages

Since the Klydonograph was put to broad use the early, indefinite conceptions as to the magnitude of transient voltages due to lightning have been superseded by rather definite, though not entirely complete data. It is realized now that line construction and insulation on the lightning voltages which may reach a station, heretofore really recognized only by a few specialists and ignored by the industry as a whole, has been so clearly illustrated that now it is a part of the general understanding.

Agreement has replaced the earlier differences of opinion in regard to the benefits of overhead "ground" wires. More or less general misconception in regard to the relation between "surge flashover" and "60-cycle flashover" values for insulators are being cleared away and recognition is being given to the fact that the "surge flashover" for an insulator is not a single value, but a function of time.

However, in spite of these evidences of progress, we still have far to go. Though there is now available general data as to the voltage magnitude of surges as they appear on transmission circuits, little is known of their duration or of the shape of the time-voltage relation. Although the voltage magnitude on actual lines is known, the upper limit always is fixed by the line insulation (even on 220-kv. circuits with ground wires) and it is not known what values would be reached if insulation were increased indefinitely. The need for more fundamental data is evident, and when the magnitude of the barrier which lightning places in the way of accomplishing the further growth of electrical systems as now contemplated is recognized the value of meeting the need is apparent.

Efforts to secure this information are being made by at least two groups in this country. In Germany some of the manufacturers, operators and universities have joined forces to form a "society for the study of high-voltage phenomena," and this society is carrying on a comprehensive program. For some years the Swedish Royal Board of Waterfalls has supported the activities of Dr. Norinder in perhaps the most fundamental and most direct lightning studies ever made. England contributes to the work through the efforts of Dr. Simpson. The general interest in the problem and the importance of continued progress are shown by the amount and diversity of these efforts.

Just as the Klydonograph added information as to the voltages incident to the line and thus stimulated a renewal of activity and thought on this phase of the problem, so the introduction of the cathode-ray oscillograph of Dufour to the laboratory study of apparatus characteristics has given invaluable information and stimulated new thought in this second phase.

A natural conservatism together with the expectation of greatly increased information concerning the first phase of the problem thus far have prevented this new information from resulting in any major changes in commercial forms of protective equipment. It is not to be thought, however, that all benefits have been deferred. Extensive work is being done to obtain improved protective equipment in anticipation of the added information about voltages.

Co-ordinated Design of System Insulation and Lightning Protection

No longer is it the practically universal practice to treat the parts of the system as independent units so far as lightning is concerned. Engineers are beginning to recognize the unavoidable interrelation of the various parts and to design system insulation and protection as a whole.

This practice and the possibilities it has of benefits are well illustrated by a recent application study made for a 220-kv. station in a location where lightning is pravelent and severe. Previous ideas had been, without much foundation, that apparatus designed for such a voltage and using factors of safety established by experience at the lower voltages would be immune to lightning troubles. Apparatus, station and line insulation were selected so as to bear the proper relation to each other from the standpoint of strength against lightning voltages. The proposed line construction and the territory were considered in the light of other experience to determine the lightning voltages which might be expected. The way such voltages would behave within the stations was considered and the surprising conclusion was reached that even these highly insulated installations are not immune to lightning troubles when connected to lines insulated to secure even the relative freedom from lightning flashover to be anticipated in this case.

From the well established characteristics of available lightning arrester types it was determined that material benefit would result from their use. However, the conditions at this installation were unfavorable. Whole advantage of the solid neutral ground connection could not safely be taken because of the possibility of occasional high overvoltages at loss of load. The stations are large and the two extreme points requiring protection, the entrance point and the transformer, are separated by seven hundred feet. The stations are terminal points in the transmission circuit so that the voltages are nearly doubled by reflection at the transformers. Some hazard remains.

It seemed possible to minimize even these hazards by the use of rather large and somewhat complicated choke coils, but final consideration made it seem desirable to omit these. The final decision was to use an arrester for each line, connecting it to the circuit at the entrance to the station and to use choke coils of the general type and of the same general size as those in common use at the lower voltages.

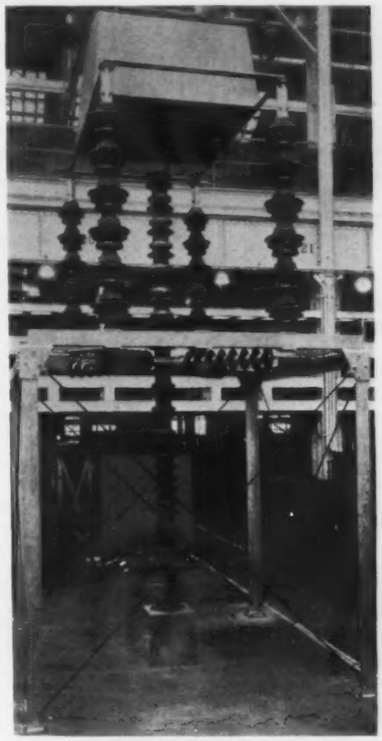
This application and the studies on which it was based marked the entrance into a new field of inquiry. Such a procedure was never really feasible before because of the indefinite nature of the available data. Even now with much better data available there remain uncertainties of major magnitude. However, in spite of present deficiencies and aside from whatever benefit may result at the particular installation, the step taken is of great value because it draws attention to the possibilities of improvement to service by consideration of the system as a whole in determining the design of protection against lightning.

Present Trends

Progress to better data, more complete analysis, and increased assurance may be anticipated with confidence as improved results are secured. Already several points are suggested as a direct result of this way of thinking.

Emphasis is given to the need for line construction design to minimize lightning voltages. Apparently it cannot be hoped that this will result in any decrease in the maximum value of surge voltage reached as long as line insulation imposes the upper limit, but it surely will reduce the number of line flashover voltages and the number of dangerous overvoltages reaching the station in any period of time.

Some thought reasonably may be given to the possibility of reduction in the severity of lightning conditions by selecting favorable locations for circuits. There is some difference of opinion as to the benefit to be gained in this way and the data in support of the thought are looked upon with some suspicion as recording merely a part of a cycle which may have a very long



One phase leg of one of the modern types of 220-kv. lightning arresters. The operating element is all in one column side-braced with insulating members. Live parts at ground level are surrounded by a protecting structure at ground potential.

period. Careful analysis of full records over a long time, however, should lead to a solution and quite probably point the way for some improvement.

The material benefit to be gained by avoiding terminal stations is emphasized. An unprotected terminal station is subjected to a voltage nearly double that on the line, while a tap station has only the same voltage as the line. In the case of a station supplied by lines in various directions, no two of which are close enough together to make simultaneous transients likely, there is a material reduction in voltage due to the decrease in surge impedance resulting from the parallel outgoing circuits. For example, at a four-circuit station with circuits separated from one another, surge voltages are reduced to one-half in this way.

Use of Distributed Arresters

Perhaps the most interesting suggestion is that of protecting the system by distributing relatively small inexpensive arresters throughout the length of the circuits. If such arresters are of a type which maintain an appreciable voltage at the arrester terminals throughout the discharge, rather than providing practically a momentary self-healing ground, they will absorb considerable surge energy and decrease or prevent travel of the surge along the line. Any one surge thus is applied to a reduced number of insulators and the hazard of trouble is decreased, as it always is when the number of parallel insulating members is reduced. If the arresters have such characteristics as to bring about material reduction in the voltage, and to do so without too much delay, some reduction in line insulator flashover will result.

If the arresters are of good enough protective quality it would be reasonable to omit the more elaborate and expensive arresters at the stations since the surges originating on the lines would not reach the stations or at least would be much reduced by the time they reached the stations. It is quite possible that the manufacturing benefits of quantity production of standardized units, such as would almost surely be used for such distributed application, would make it possible to provide an actual increase in the total protection with no increase in cost. At the same time valuable space at stations now taken for station arresters would be released. Thus this scheme has possibilities of improving station protection, reducing line insulator flashover, and releasing valuable station space all with no increase in cost.

Whatever may result from these specific thoughts which have been brought about by the recent increase in general interest in the problem, continued progress and increasing release from the troubles lightning now causes may be counted upon.

Stainless steel for ferry propellers has been found by the Key System Transit Company of Oakland, Calif., to increase the operating efficiency of the ferries. According to H. P. Bell, vice-president in charge of engineering for that company, the old regulation cast-iron propellers required semi-annual replacement due to wear and corrosion losses. This frequent replacement introduced not only the element of labor and dry-dock expenses, but took the boats out of service. The stainless steel propellers have been tried out for two years on one of the company's ferries and after 24 months' continuous service show no appreciable signs of wear or corrosion. The new propeller is fabricated with the aid of electric welders and is expected to be good for seven years' continuous service.

Specially Designed Line Truck Provides Space for All Equipment

MOST line trucks are merely built, some are designed more or less piecemeal, but only a few really are planned and laid out to give the utmost service to the line crew of whose daily life they are a most important part. One of two new 1½-ton trucks placed in service during 1927 in the Boise district of the Idaho Power Company is shown in the accompanying group of illustrations. Two new truck chassis complete with cabs were purchased by the company and upon each chassis M. W. Oldfield, line foreman, M. R. Priest, shop foreman, and J. R. Crowe, division manager, proceeded to plan and build a body designed to fit exactly the needs of the line crews.

Particular attention was given to the diversity of equipment to be carried and to making this equipment immediately accessible without the necessity of the usual "pawing over" of the quantity of material ordinarily found in a line truck without special compartments. As may be noted in the illustrations there are five drawers on each side of the truck, three in front of the rear wheel and two at the rear of it. Spaces for these drawers were provided between the floor timbers of the truck.

No. 12 black iron was laid directly on the chassis beams and oak floor joists placed directly on top of the steel plates, making a very solid job. The steel plates give a good foundation for the drawers which are loaded with heavy line material such as bolts, staples, washers, insulators, crossarm braces and other equipment of comparatively small dimesions but heavy weight. The drawers themselves are subdivided conveniently into smaller compartments.

On the front end of the body just above the level of these drawers may be seen a small sliding door which opens into a pocket extending between the front of the body and the mud guard over the rear wheel. This pocket is 8 in. in cross sectional dimension and 7 ft. long. At the rear end of this space at the right-hand side of the truck there is a small drawer 3 in. deep, 9½ in. wide and 27 in. long in which bits are carried. Immediately above this there is a compartment 10 x 10 x 30 in. serving as a general tool box for braces, saws and such tools.

Along each side of the truck may be noted four trap doors above and in the spaces corresponding to the drawers. These doors cover pockets in the side of the car, three of which are 8 in. high, 12 in. deep and 18 in. long and the fourth (over the rear wheel) 38 in. long, 8 in. high and 12 in. deep. These pockets are very convenient for carrying linemen's belts, safeties and spurs.

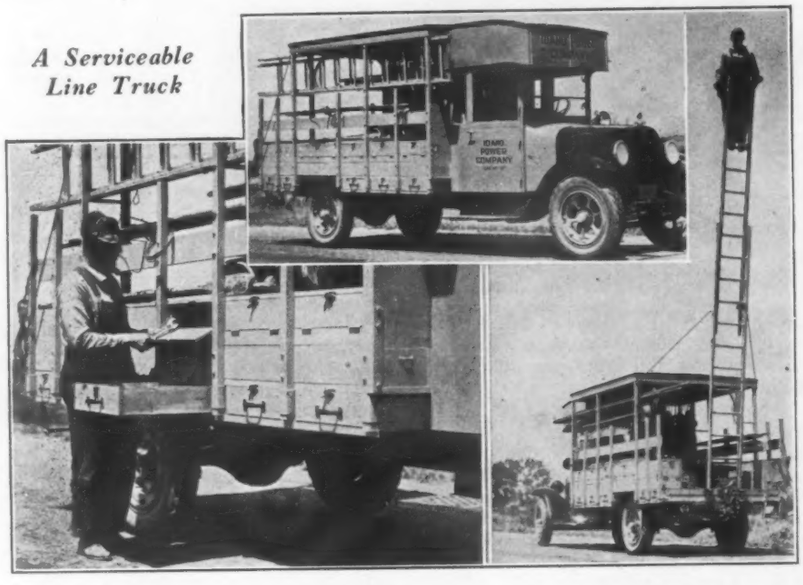
Above the driver's cab is a compartment 42 in. wide, 13 in. high and 41 in. long which is used for carrying the rubber protector goods. This arrangement works out particularly well because these rubber goods are readily accessible and yet are not subject to abuse by being walked upon nor are they chafed by coming into contact with loads or with other equipment.

A ladder, pike-poles, shovels and other long tools are carried in racks provided on the sides of the superstructure. A trailer coupler and a yoke for use when trailing a load of poles also are permanent equipment. The yoke is swiveled in a vertical position and has several spurs which grip the end of the pole to keep it from slipping. Ropes and other tackle are carried in the top of the car suspended by chains fitted with a snap-hook on one end.

The ladder feet are equipped with half of a heavy strap-hinge which may be bolted into the corresponding fittings permanently mounted at the rear end of the truck floor as shown. The ladder braces are attached permanently to the rear uprights of the truck superstructure by means of eye-bolts. When not in service holding the ladder they are carried down in a nearly vertical position and held in place by a pair of clips. This ladder arrangement has been found to be particularly useful for many different purposes, particularly in trimming trees.

Another feature of the truck that is worthy of mention is the fact that the floor is only 35 in. above the ground whereas ordinary trucks of this size have a floor that is higher by at least 6 or 8 in. The truck color scheme is grey body with black hood and fenders. These trucks have proved particularly satisfactory in service.

A Serviceable Line Truck



A line truck designed by and for a line foreman. At the left may be noted details of the drawer and compartment construction which provides handy storage for small parts. At the right the ladder is shown extended, and above the center is the truck as it appears when traveling.

Radio-Frequency Filters for Household Appliances

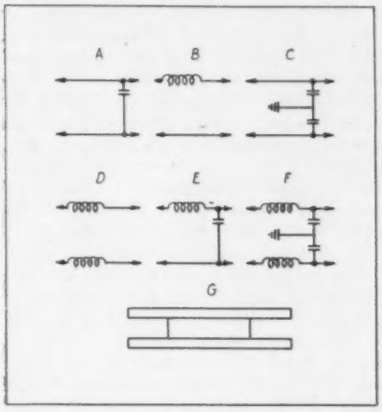
With the increased sensitivity of radio receiving sets and with the increasing public appreciation of "quality" in radio music, the question of radio interference becomes more and more important. As a feature affecting public relations, radio disturbances are of prime importance.

There really are three major sources of trouble: disturbances originating on power lines, disturbances originating in household appliances, and disturbances originating in some portion of the radio equipment itself. Since power lines are carriers of radio disturbances it is considered that as far as residential sections are concerned the power lines are responsible for spreading disturbances which occur in industrial establishments. The first of these items is the immediate and complete responsibility of the power company whereas with the second and third items the question becomes one of education of the householder and radio set user wherein the best progress is made through the instructive co-operation of qualified power company representatives.

As far as line troubles are concerned, careful attention to details both in overhead and underground construction will remove most of the more common causes of radio disturbances. Faulty insulators can be detected and replaced, loose hardware can be tightened up and well bonded, and clearances can be maintained carefully and consistently. Careful attention to details during construction on new work and a careful overhauling of old work will pay dividends in reduced radio disturbance complaints.

In the average residential neighborhood some of the most serious disturbances have been traced directly to various household appliances, small single-

phase motors, oil-burning furnaces with motor driven equipment, "spark-plug" lighters on gas furnaces, thermostatic control devices on household heating appliances, and many other similar items. When it is brought to the attention of the householder and demonstrated unquestionably that these appliances are causing radio disturbance not only within his own household but to his neighbors, the householder usually is willing to co-operate in their suppression. Since the power company and its employees are supposed to know all there is to know about the handling of electricity, it is only logical that the power company should assist in educating the householder and also in educating the average radio dealer concerning interference from household appliances.



Schematic diagrams of various filter combinations and a sketch of a winding form for radio-frequency choke coils.

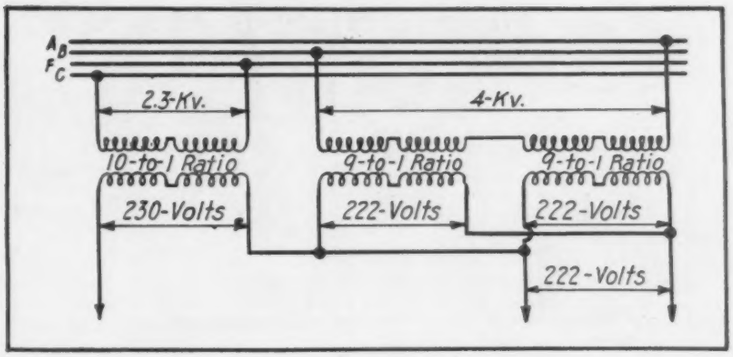
In most cases the elimination of the faulty appliance is quite impossible and the question becomes one of suppression or localization of disturbance. As far as protecting adjoining householders is concerned the logical step is to install a combination of radio-frequency choke coils and by-pass condensers at the point where the service leads enter the house.

One of the Pacific Coast power companies has conducted rather extensive experiments regarding the suppression of such radio interference and the accompanying illustration shows diagrammatically some of the combinations that have been used with satisfaction. In that illustration "A," "B," "C," "D," "E," and "F" represent six different means of taking care of disturbances of various natures and varying degrees of severity. "G" represents a winding form much reduced in size, of course, but of correct proportions for the construction of effective radio-frequency choke coils such as those used in the diagram. On those coils from 60 to 150 turns of wire generally are sufficient when wound upon a core 2 in. in diameter. Of course it is necessary to take care to use wire of a sufficient size to carry the necessary load current. It should be remembered also that there is no heat radiation from the inside turns of these coils. For small coils, paraffine-treated hardwood spools work out very satisfactorily.

As for condensers, it was found that a small stock of telephone condensers of 0.5, 1.0 and 2.0 mfd. capacity provides sufficient selection with minimum investment.

With a small stock of coils ready wound up and a reasonable stock of condensers of the three sizes mentioned it is possible satisfactorily to take care of practically all cases of appliance disturbance that may be met with. It is recommended that the condensers be insulated for at least 500 volts for normal continuous service on 110-volt circuits. The equipment and the scheme both are effective and comparatively inexpensive.

Where there is household equipment that must run for long periods and which causes severe radio interference, the application of one of the filters in the immediate circuit of the device itself will be well worth while.



A 2-phase 3-wire transformation from 4-kv. 4-wire Y, using standard transformers.

3-Phase to 2-Phase With Standard Transformers

By V. W. Palen

Where it is desired to furnish 2-phase, 220-volt power from a 3-phase, 4-wire Y-connected, 4-kv. primary circuit a large Eastern power company used three standard transformers connected as shown in the accompanying diagram. Most standard transformers are provided with 9/1 and 10/1 taps and with this connection the 2-phase voltages are balanced sufficiently to obviate the necessity of a special 87-per-cent-tap transformer.

In practice the 10/1 transformer usually is about 1½ times the capacity of the 9/1 transformers. For instance, one combination often used is a 7½-kva., 10/1 transformer with two 5-kva., 9/1 transformers. Since the two 9/1 transformers are operating below normal voltage the kva. capacity is reduced thereby. In the case cited the two 9/1 transformers are able to carry safely about 8 kva., which with the 7½-kva. transformer make up a fairly well balanced bank.

Portable Crane

A portable crane developed and used by the engineering department of the Los Angeles Gas and Electric Corporation. All of the main pieces are tubular and the boom length may be adjusted by means of the tube-within-a-tube construction with transverse holes and locking bolts. The light tractor carries the crane and furnishes the operating power. The total cost of the apparatus as shown was about $4,400, a comparatively small investment.

Watthour Meter Accuracy as Affected by Temperature Changes—I

By D. T. CANFIELD, Instructor in Electrical Engineering, Purdue University, Lafayette, Indiana*

THE PAST few years have witnessed considerable activity in investigations of changes in the registration of watthour meters caused by changes in ambient temperature. This research, however, has been directed principally along development lines with a view toward designing a temperature compensator meter.

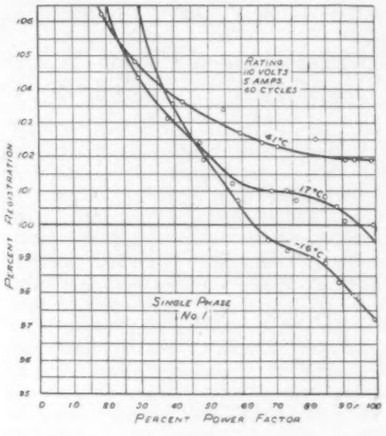


Fig. 1. Typical performance curves of meter No. 1.

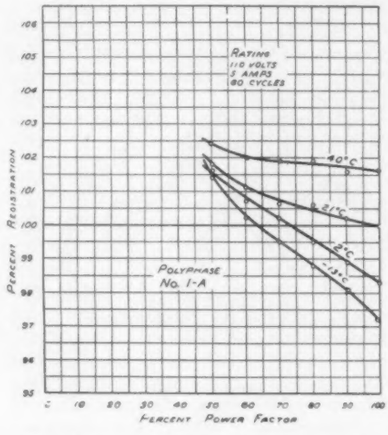


Fig. 2. Typical performance curves of meter No. 1-A.

It was while the author was engaged in such a line of research for the Duncan Electric Manufacturing Company, whose generous co-operation is acknowledged herewith, that the opportunity presented itself to obtain a set of typical performance curves of several standard makes of induction-type watthour meters at different temperatures.

It is the purpose of this article to present these curves, devoid of identification and technical discussion, in order to show the actual magnitude of the errors that exist.

At the outset it can be said that these errors are relatively very small and they become appreciable only at temperatures outside of the range of temperatures to which meters normally are exposed. This fact should be kept clearly in mind in any discussion of so-called temperature errors.

Apparatus

For the purpose of making the tests, a special refrigerator box was constructed. This box was divided into three horizontal compartments. The middle compartment contained the expansion coil of a domestic-type electric refrigerator. The two end compartments, which contained the meters being tested, were fitted with glass observation windows. These windows had three panes separated by 2-in. dead-air spaces to afford insulation and to prevent fogging. Ample ducts were cut in the top and bottom of the cork partitions separating the compartments, to allow for free circulation of the air. Each compartment was about 1 ft. wide, 2 ft. high, and 2 ft. deep. Two layers of 2-in. cork boards were used in the construction of all outer surfaces. Access was obtained through the top. With this arrangement there was no appreciable temperature gradient horizontally and only about 3 deg. vertically from top to bottom of the box.

The meters under test were hung on tripods about half-way up in each end compartment. The necessary wires entered through sealed bushings in the rear.

To afford heat for the higher temperatures, twelve 50-watt incandescent lamps also were installed in the floor of the box, three in the front and three in the rear of each end compartment.

In addition to the main box, a small one was built along similar lines to house the standards. This box was equipped with two incandescent lamps which were regulated to give a constant temperature of 30 deg. C. This temperature was maintained throughout all tests.

The current coils of all meters including the standards were connected in series with suitable switches and regulators to a lamp load. The potential coils of all meters were connected to the secondary of a phase shifter and regulating device and, to reproduce as nearly as possible actual service conditions, were kept excited day and night throughout the entire test. Suitable indicating instruments were inserted in the circuit for controlling purposes.

Two standards were mounted side by side in the constant-temperature box. One was used as a working standard and the other as a check from time to time. These standards were ordinary induction-type watthour meters with special bearings top and bottom and with the gear train removed to eliminate all possible friction. The disc of each was marked with 100 equal divisions. These meters were calibrated carefully and frequently checked.

For polyphase measurements the box was wired with a complete three-phase circuit controlled in a manner similar to the single-phase circuit. A polyphase standard equipped in the same way as the single-phase standard was installed in the constant-temperature box.

Procedure

To determine the time required for a meter completely to absorb a change in temperature in the box preliminary tests were made with meters which had their magnets wound with a number of turns of iron wire which coils then were connected to a Wheatstone bridge and a sensitive galvanometer. When no change in the resistance of these coils could be detected it was assumed that the temperature of the meter had become constant after a change of temperature in the box, since the magnets represented the largest mass of metal to be changed. Repeated tests of this

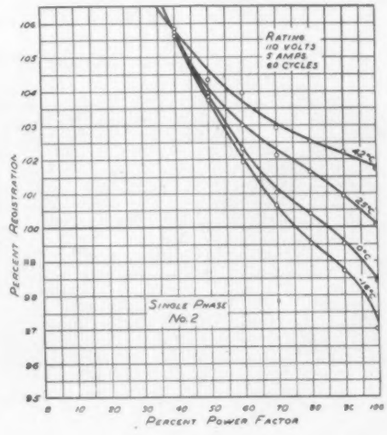


Fig. 3. Typical performance curves of meter No. 2.

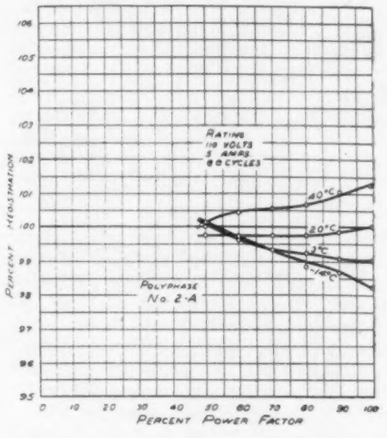


Fig. 4. Typical performance curves of meter No. 2-A.

*From Bulletin No. 22, Engineering Experiment Station, Purdue University.

kind established the fact that from 4 to 5 hr. were required to assure constant conditions after a change of approximately 20 deg. C. Therefore, at least 4 hr. were allowed to elapse after a change of temperature before another test was made.

Preliminary tests also were made to determine the range of temperatures and the co-ordinates to be used which would give the best indication of the performance of the meters. These indicated that a range from approximately –20 deg. C. to 40 deg. C. was ample. This represents a range of from 4 deg. F. to 104 deg. F. Determinations at 20-deg. intervals within this range were considered sufficient to show very effectively the typical performance of any meter.

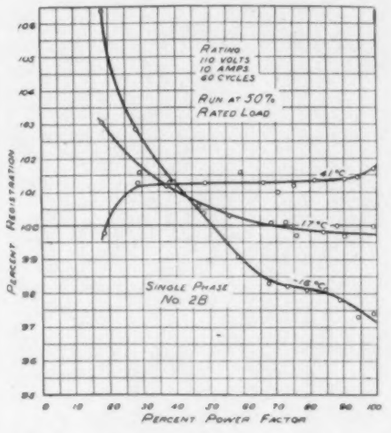


Fig. 5. Typical performance curves of meter No. 2-B.

Since, as previously pointed out, any change in temperature was accompanied by considerable delay the number of these temperature changes was reduced to a minimum. To this end, power factor was made the independent variable at constant temperature. In this way a number of points on each curve could be obtained readily, thereby assuring ease of plotting. For performance at a given power factor, it is necessary only to read the curves vertically. In order to minimize personal errors as much as possible a number of determinations were made at each setting and the average of these values was plotted.

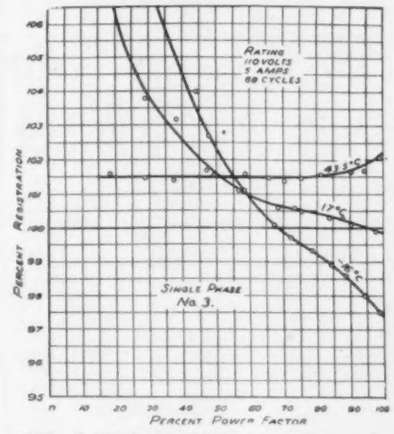


Fig. 6. Typical performance curves of meter No. 3.

Since the object of these curves is to show a comparison of the performance of various makes of meters, and not a comparison of the calibration the meters happened to have at the time the tests were made, it was necessary to choose an arbitrary correct speed for each meter at some power factor and temperature common to all for the purpose of calculating per-cent registration.

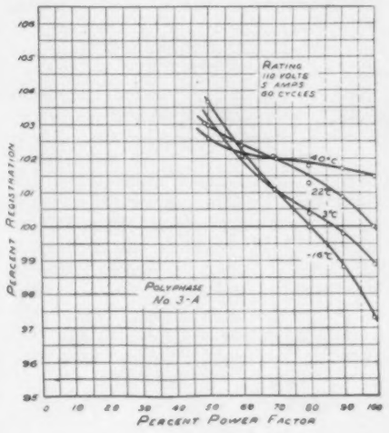


Fig. 7. Typical performance curves of meter No. 3-A.

In every case the speed of the meter at unity power factor and that temperature nearest to 20 deg. C. was used arbitrarily as the theoretically correct speed, whether or not it was the actual correct speed. Thus in Figs. 1, 5, 6, 8 and 11 the speed at unity power factor and 17 deg. C. was assumed to be the theoretically correct speed.

In Fig. 2 it was 21 deg. C., in Fig. 3 it was 25 deg. C., and so forth.

The meters are numbered according to manufacturer. Thus, in other words, meters No. 1, 1-A, etc., are the product of one manufacturer while No. 2, 2-A, 2-B, etc., are of another manufacturer.

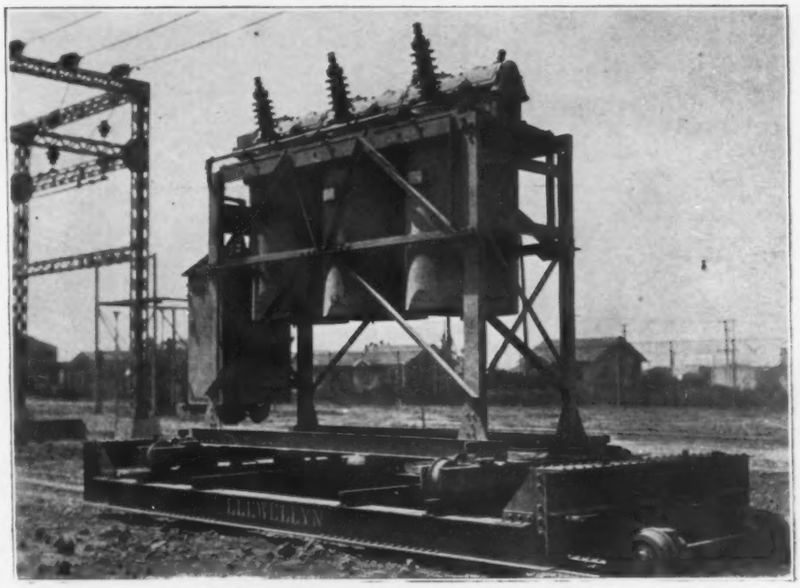
EDITOR'S NOTE: The second and concluding portion of this article is scheduled to appear in the next issue of ELECTRICAL WEST.

Special Car Facilitates Oil Circuit Breaker Handling

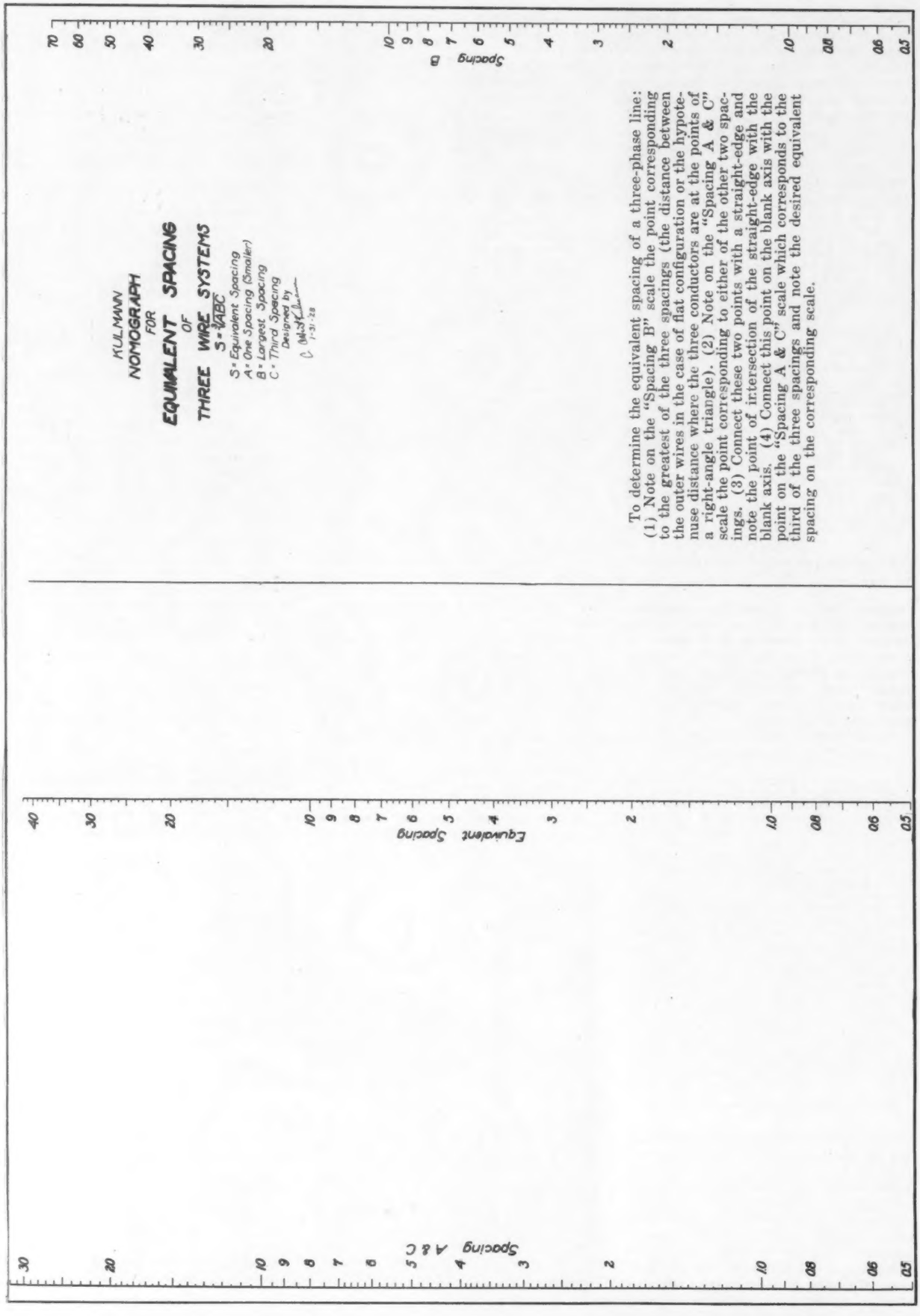
At the Century receiving substation of the Los Angeles Bureau of Power and Light the handling of the 33-kv. oil circuit breakers has been simplified and expedited materially through the use of the car shown in the accompanying illustration. The car was fabricated especially for the job and it may be noted that it is slung with the bed at a minimum elevation.

Transversely on the bed are mounted sections of steel rail so located that they coincide with the rail mountings of the oil circuit breaker foundations. The oil circuit breakers themselves are frame-mounted, the frames being fitted permanently with flanged wheels as shown. Thus the circuit breaker may be rolled directly from its normal bus position onto the bed of the car, it being necessary only to remove first the holding clamps and electrical connections. A system of trackage which connects with all of the bus sections at this receiving substation leads directly into the repair room of the substation building, thus making it possible to do all circuit breaker repair work under cover.

Motive power is furnished by an old electric truck which served its normal life in line construction duty and which was retired to intermittent duty hauling this car around the yards of the Century receiving substation. This truck has been fitted with light-weight flanged car wheels so that it operated on the tracks. The truck battery is charged from the station d.c. system.



A car for hauling oil circuit breakers from substation yard into repair room of substation building.


KULMANN
NOMOGRAPH
FOR
EQUIVALENT SPACING
OF
THREE WIRE SYSTEMS
S=√ABC
S= Equivalent Spacing
A= One Spacing (Smaller)
B= Largest Spacing
C= Third Spacing
Designed by
1-31-28
Spacing B
Equivalent Spacing
Spacing A & C
To determine the equivalent spacing of a three-phase line: (1) Note on the "Spacing B" scale the point corresponding to the greatest of the three spacings (the distance between the outer wires in the case of flat configuration or the hypotenuse distance where the three conductors are at the points of a right-angle triangle). (2) Note on the "Spacing A & C" scale the point corresponding to either of the other two spacings. (3) Connect these two points with a straight-edge and note the point of intersection of the straight-edge with the blank axis. (4) Connect this point on the blank axis with the point on the "Spacing A & C" scale which corresponds to the third of the three spacings and note the desired equivalent spacing on the corresponding scale.

Nomograph for the Determination of Equivalent Spacing of Three-Wire Lines

By C. Albert Kulmann, Pelton Water Wheel Company, San Francisco.

THE first step in solving any of the equations for electric transmission lines is to determine the equivalent spacing of the conductors. Although the equation is simple it entails the use of cube tables or logarithms and its solution does take time. The equation is

$$s = \sqrt[3]{abc}$$

where **s** is the equivalent spacing, and **a, b** and **c** are the spacings between each of the pairs of the group of three conductors.

With the nomograph presented on the opposite page an accurate solution of this equation may be obtained very simply. To use the chart note on the "Spacing B" scale the greatest of the spacings, the distance between outer wires in the case of the three wires being in line or the hypotenuse where the wires are the vertices of a right-angled triangle. Using a straight-edge, connect this point with the point on the "Spacing A & C" scale which corresponds with either of the other two spacings, noting the point of intersection of the straight-edge with the blank axis. Connect this blank axis intersection point with the point on the "Spacing A & C" scale corresponding to the third spacing, and read the equivalent spacing as indicated by the point of intersection of the straight-edge and the "Equivalent Spacing" scale.

To illustrate the use of this nomograph assume the case of three conductors lying in the same plane with the nearest wires 10 ft. apart. One distance then will be 20 ft., that between the two outer wires, the other distances being 10 ft. each. Lay a straight-edge from 10 on the left-hand scale to 20 on the right-hand scale and obtain the point of intersection with the blank axis. Connect this (blank axis) point with the third distance, 10 on the same scale as before, the left-hand one, and read on the "Equivalent Spacing" scale the value 12.6. It may be seen that for the special case where the three wires are in one plane only one operation is necessary, and the result may be read at the first placing of the straight-edge.

Editor's Note: This is the third of a series of useful nomographs prepared by the author from mathematical and experimental data. The fourth will appear in a subsequent issue of Electrical West.

NEW BOOKS
for the Engineer

MODERN CONCEPTIONS OF ELECTRICITY, "a lucid explanation of many of the latest theories concerning atoms, electrons and other matters relating to electricity," by Charles R. Gibson, LL.D., F.R.S.E.. First edition, 1928. 5¾ x 8¾ in.; cloth; 284 pages; 65 illustrations. Published by J. B. Lippincott Company, Philadelphia. Printed in Great Britain. Price $5.—A notable and noteworthy effort on the part of the author to present a non-technical, non-mathematical treatment of modern conceptions and theories. He deals with his subject from the experimental side showing how the present understandings and theories of electricity and matter have been built upon and have grown out of actual experiment. For those who are interested in or curious about the Theory of Relativity and the Quantum Theory and who have not the time nor inclination to study the technical books dealing with electrical phenomena, this book should prove of great interest and value. It is written in an interesting "popular" style. This is more than a "book for the engineer," it is a book for everyone interested in the "why" of modern conceptions, most of which are very different from those of our school days.

STRENGTH TESTS ON WESTERN CEDAR POLES—Circulars Nos. 21 and 22 issued by the Canadian Department of the Interior and prepared by T. A. McElhanney and R. S. Perry, engineers of the Vancouver, B. C., laboratory, Forest Products Laboratories of Canada.—These pamphlets deal respectively with green-cut poles and with the relative strength of green-cut and fire-killed poles. The methods and materials of test are described and extensive tabular information resulting from the tests is given. These circulars may be obtained upon application to the Best Products Laboratories, Vancouver, B. C., or from the Director of Forestry, Ottawa.

A COURSE IN ELECTRICAL ENGINEERING, Vol. II, Alternating Currents, by Chester L. Dawes, S.B., assistant professor of electrical engineering, the Harvard Engineering School. Second edition, 1928; 6 x 8 in.; cloth; 456 illustrations. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York. Price $4. For sale by Technical Book Shop, 883 Mission St., San Francisco.—This text is designed for use in courses in electrical engineering in advanced trade schools or the equivalent and for certain courses in electrical engineering in engineering schools and universities. In fact this second edition has been prepared not only to bring the book up to date, but also to strengthen the treatment of certain subjects to meet the demands of improving standards of engineering education. Complex quantities and their application, and vacuum tubes and their characteristics have been added. The treatment pre-supposes only a general knowledge of direct-current phenomena such as is given in Vol. I.

ELECTRIC LINES AND NETS, their theory and electrical behavior, by A. A. Kennelly, A.M., Sc.D., professor of electrical engineering at Harvard University and past-president A.I.E.E. Second edition, revised and enlarged, 1928. 6 x 9 in.; cloth; 426 pages; 222 illustrations. Price $5. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York. For sale by Technical Book Shop, 883 Mission St., San Francisco.—This book is offered to students of electrical engineering as a revision of the author's earlier book, "Artificial Electric Lines," issued in 1917 and now out of print. Some of the earlier material has undergone abridgment and condensation and new material has been added to bring the subject up to date from a text-book point of view. Since the text deals with actual lines as well as artificial lines, the title has been changed accordingly. The method of treatment is not highly mathematical.

GETTING FACTS ABOUT ACCIDENTS, a pamphlet distributed free of charge by the Metropolitan Life Insurance Company, New York or San Francisco, and explaining methods of obtaining and using accident statistics in industrial accident prevention work.

PROBLEMS IN ALTERNATING CURRENT MACHINERY, by Waldo V. Lyon, associate professor of electrical machinery, Massachusetts Institute of Technology. Second edition, 1928; 6 x 9 in.; cloth; 243 pages; 21 illustrations. Price $2.25. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York. For sale by Technical Book Shop, 883 Mission St., San Francisco.—As indicated by its title, this book is devoted to problems concerning the theory of operation of alternating current machinery and other phases of electrical theory. The book was designed as a problem text for fourth-year students in electrical engineering and a wide selection is offered in the problems presented, both as to subject matter and as to difficulty in solution. Problems are arranged in chapters according to the subject dealt with and each chapter group is arranged in logical sequence. There are 202 transformer problems, 207 generator problems, 104 synchronous motor problems, 134 synchronous converter problems, 133 induction motor problems, and 62 general examination problems. The book should prove of value to instructor and student.

ELECTRIC CIRCUITS—THEORY AND APPLICATION, Vol. 1, short-circuit calculations and steady-state theory, by O. G. C. Dahl, associate professor of electric power transmission, Massachusetts Institute of Technology. First edition, 1928. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York. Cloth bound. 6 x 9 in.; 390 pages; 228 illustrations. Price $5. For sale by Technical Book Shop, 883 Mission St., San Francisco.—The author's stated purpose in this book is to present the engineering aspects of circuit theory. Although the subject matter is essentially theoretical, the language and viewpoint of the book are those of the engineer because of the author's experience as an engineer as well as a teacher. It gives the tools and methods necessary for the analysis of modern power-circuit problems. It should serve well as a textbook in advanced electrical courses and also should be of service to the practicing engineer interested in transmisson problems. The treatment is necessarily mathematical.

HEAVISIDE'S ELECTRIC THEORY, by Louis Cohen, Ph. D., consulting engineer, professor of electrical engineering at George Washington University. First edition, 1928. 6 x 9 in.; cloth, 169 pages; 28 illustrations. Price $2.50. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York. For sale by Technical Book Shop, 883 Misison St., San Francisco.—"Electrical engineering is to be congratulated upon the fact that Dr. Cohen in his book gives us a splendid summary of that part of Heaviside's mathematical analysis which bears upon the theory of the electric circuit. It will be found that Dr. Cohen's presentation of this subject is so clear and simple that many of the difficulties which the student finds in Heaviside's original work have disappeared. Heaviside's work is epoch making and every electrical engineer should familiarize himself with it to that extent, at least, which is given in the judiciously selected parts discussed in this excellent book." So says Dr. Michael I. Pupin. Of course, this is a mathematical text.

COMMERCE YEARBOOK, 1928, Vol. 1, United States. Compiled by the bureau of foreign and domestic commerce of the U.S. Department of Commerce and published by the U.S. Government Printing Office, Washington, D. C. Price $1.25. Cloth bound; 708 pages; 6 x 9 in.; illustrated. Contains statistical information originally collected by numerous government bureaus, trade associations and trade journals. Contributed to by the bureau of foreign and domestic commerce, census bureau, bureau of mines, bureau of agricultural economics, Federal Reserve Board, Interstate Commerce Commission, the Shipping Board, the bureau of labor statistics, and the American Iron and Steel Institute.

BLASTER'S HANDBOOK, prepared under the direction of Arthur LaMotte, manager of the technical section, E. I. du Pont de Nemours & Company, Inc., explosives department, Wilmington, Del. Fifth edition; cloth; 4 x 7 in.; 215 pages; 210 illustrations.—A veritable mine of information for those interested in and handling explosives. Qualified persons may obtain a copy of this booklet free of charge by addressing the above-mentioned company.

Ideas for the Contractor

Locking the Stable to Save the Horse

Some Reasons Why the Biddle Credit Plan Was Awarded the 1928 James H. McGraw Medal for Constructive Contractor Effort

"A MAN accidentally killed is just as dead as his fellow corpse and may be a greater loss to humanity than many of those who die a natural death," says N. J. Biddle, in speaking of electrical contractor business failures.

Every year the danger to reputable business firms doing electrical contracting increases under the vicious warfare of competition in which the ignorant and unbusinesslike indulge. In many sections of the country the condition has become so bad that the entire electrical contracting situation has become completely and hopelessly demoralized.

Feeling that the fundamental fault in the situation is one of unwise and unsound extension of credit, Nicholas J. Biddle, manager of the Association of Electragists, at Detroit, worked out a very simple and yet exceedingly effective credit plan which has been given his name. So constructive a piece of work was this plan considered that the James H. McGraw Award for contractors for 1928 was awarded to Mr. Biddle at the last Electragist convention at Chicago.

What Is the Biddle Plan?

The credit plan itself is of the utmost simplicity. It took a good deal of preliminary work and many meetings to bring it about but after some months of work the Detroit branch of the Association of Electragists, International, passed and received the co-operation of the electrical supply jobbers of that city to put into effect the following credit policy:

> Cash discount will be allowed on the tenth for the preceding month's purchases, provided the account is paid in full and no back balances exist. In case discount date falls on Sunday or legal holiday the next business day will be so considered.
>
> Any customer whose account is not discounted on the tenth and remains unpaid on the last business day of the month automatically will appear on the arrears list for the information of our members until the account is paid.

It was only after determined insistance on the part of the contractors that this policy was adopted and became effective Aug. 1, 1926.

The first step necessary was for the jobbers and contractors to agree on definite terms of sale. To be successful this agreement of sale must extend not only to the jobbers affiliated with any one association but to all jobbers or at least to practically all jobbers within the district covered.

Not to eliminate clean competition but to nip failures in the bud and set up business ability as the deciding factor for survival in the construction industry.

At first it was felt by some contractors that this was a purely jobbers' concern. "However, it is more than that," said Mr. Biddle. "Any jobber's policy, or lack of it, which affects adversely the business of the contractors is also their business. They have a moral right to use every means in their power to remedy such unsatisfactory conditions. Contractors spend the money of construction and as a considerable proportion of their purchases are placed only with such producers and jobbers and others as play a clean-cut ethical game, then the success of the program is assured definitely."

Under this arrangement in Detroit, the electrical supply jobbers immediately formed a trade group with the Detroit Association of Credit Men for the purpose of interchanging credit information. This detail is accomplished as follows:

Credit Men Help

On or about the 25th of each month each participating jobber files with the credit association a list of all his customers who have not paid for their previous month's purchases. From these reports the credit association compiles a master arrears list which is sent to each participating jobber. Any accounts paid after this time are reported immediately to the credit association which sends out a bulletin to all jobbers clearing the account.

On or about the fourth of the following month there is a jobbers' meeting to consider the information as collected. Those companies who over a period of six months have been unable to clear their accounts and those who have otherwise proved their inability properly to carry on a legitimate business are placed on an extra hazardous list. Most jobbers are not keen for this class of business for it represents too small an outlet.

For the purpose of investigating and supervising this work there was established a credit committee of three men: one from the Association of Credit Men, one jobber representative and the manager of the Electragists' association.

When a contractor is in temporary difficulties due to conditions over which he has no control, and where extenuatinf circumstances can be proved, he has the privilege of appearing before this committee and requesting assistance. If warranted, after careful investigation, he may be granted an extension of time or such other help as the committee deems advisable. In such case he operates under the supervision of the committee and soon he is on the way to financial stability or fails entirely. This particular section of the work has been of tremendous help to some of the contracting firms of Detroit.

That such a program is effective is proved by the following figures: On Aug. 1, 1926, there were approximately 850 electrical contractors licensed to do business in Detroit. By April 1, 1927, this number was reduced to 740 and still further reduced by March 22, 1928, to 481.

The past due receivables of the jobbers on Aug. 15, 1927, according to the credit bulletin, amounted to $207,000 and on Aug. 15, 1928, to only $39,000.

"This activity is in thorough accord with the fundamental law of the survival of the fittest, merely accelerating the faction in a perfectly legal manner," explains Mr. Biddle. "Those firms not properly qualified with capital and with good business ability are eliminating themselves from the field and the jobbers are investigating carefully newcomers to make sure that such are sufficiently well qualified to have a chance of success. The result is that those leaving the field are not being replaced by a large crop of newcomers of no more ability or better equipment.

"Undoubtedly this reduction in numbers will continue until an economic balance is reached and will insure Detroit a group of well-qualified electrical contractors in the near future. Carrying on such an activity requires continuous and conscientious effort over a

long period of time and should not be undertaken by any group unless it is fully prepared to carry it through to a final conclusion.

"No able business man fears intelligent competition, but he does fear the crazy, cut-throat variety with which the entire building industry is afflicted. This sort of competition cannot long survive under such a credit situation.

"The point is raised sometimes that the adoption of such a program may work a tremendous hardship on many capable men trying to make their way in the contracting business," he continues. "Certainly requiring a man to measure up to some standard before granting him the privileges of obtaining credit is not placing him under a handicap. Rather it is giving him a mark to shoot at which will create undoubtedly a higher respect for the building industry in his consciousness. It merely speeds up his success or failure and in the event of failure will save him from becoming involved to the point where bankruptcy, with its stigma, is the only answer.

"Then, too, there is no obligation on the part of the building industry to furnish novices and unqualified misfits with the means of further demoralizing the industry.

"It is realized that the unsound and unethical practices indulged in by most of this class of business men are not intentional but due chiefly to lack of knowledge. Nevertheless damage which such men do to those business men who are carrying on their businesses on a legitimate basis is no less severe because of this fact. The man killed accidentally is just as dead as his fellow corpse.

What Is Credit?

"This whole plan is based on credit. It is well to understand clearly just what credit is.

"Credit is a mercantile reputation entitling one to be trusted. It should be based upon financial stability, plus payment habit. Field practice is even more important in order that accurate and unbiased information can be obtained as to these factors.

"Credit is not something that can be granted by someone else. It is a condition of being able to meet obligations or quantity of trustworthiness established by the purchaser himself. Certain standards should be set up as a basis for recognition.

"Insistence on the part of the seller that a purchaser measure up to these standards, if equitable, is good business and a protection to all parties involved.

"A jobber has obligations to his prompt-paying customers which are: first, that he grant no better terms to others; second, that he so handle credit that his losses will be minimized to the greatest possible extent.

"Unavoidable losses and bad accounts are numerous enough and rightly a part of overhead. Losses due to gross carelessness in the handling of credit are not rightly chargeable to the overhead which must be borne by all others dealing with that jobber on a legitimate basis. They are rightly chargeable as a loss to the seller.

"That credit is a privilege and not an obligation on the part of the seller is indisputable, although not so considered by many purchasers. There should be the same inflexibility in terms of credit purchases as are required by a bank. On the other hand, there should be a willingness on the part of the purchaser to meet these conditions promptly.

"The effort displayed by a purchaser is indicative of his ability as a business man. Preservation of credit privilege is the first concern of able management. The three essential elements requisite in a good credit risk are, character capacity and capital. Credit is the keylog in the jam of the building industry, —therefore, the logical point of attack."

Courts Unhold the Method

In reviewing the legality of this plan several decisions of the supreme court have been found favoring such a method. The supreme court of Florida, in the case of Putnam vs. Inman, sets forth as follows: "'The matter of extending credit is a large part of modern business. Merchants have a right to organize for their own protection and agree to report to each other the name of a person to whom credit has been extended, who has failed to pay his account, and agree that they will not extend credit."

Other supreme court decisions uphold this theory of credit practice in a number of instances. There has never been a case of record where the courts have rendered a decision adverse to collective sound credit practice where such collective effort has been limited to credit only.

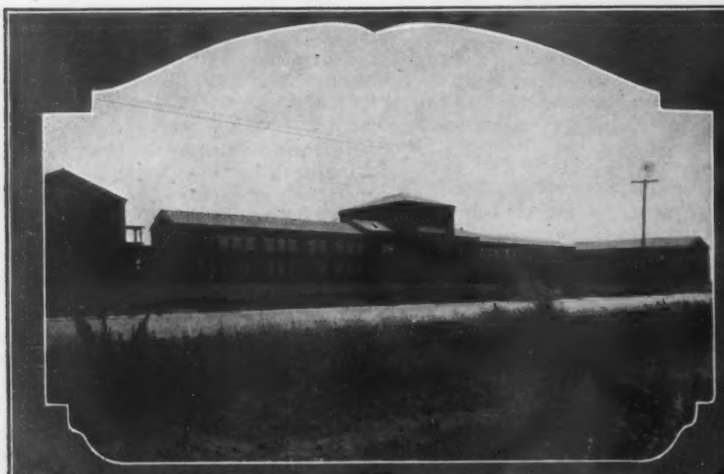
"In the mad scramble for business," explains Mr. Biddle, in showing the causes for present conditions, "producers with over-capacity create new jobbers and jobbers start more contractors. The intent is to sell more goods, of course, but the result is entirely opposite. Building construction under such conditions is done on the basis of what can be eliminated or substituted to decrease the cost. The loss in possible gross volume to the construction industry due to substitution and elimination is tremendous.

"Then, too, the market created is actually a sub-cost market induced by the loose credit practice which prevails. It is possible by pyramiding accounts for contractors and jobbers to do business at a loss for so long a period that they can increase their volume constantly. Years may elapse sometimes before their peak business is reached. This naturally brings a showdown but is not necessarily the closing up of such a concern. Often a firm is so deeply involved with its suppliers that the latter flinch from facing the loss, continuing it in business hoping that by some miracle it may be able eventually to pay up.

"Those companies attempting to conduct business in a sound, ethical manner are penalized to such a degree that they must follow either the general practices or stay out of the picture unless something is done for their protection. The construction industry as a whole has reached a point where it is viewed skeptically by banks, bond and insurance companies.

Portland Fixture Specialists in New Salesroom and Shop

When it moved into its new quarters recently the J. C. English Company, fixture specialists of Portland, provided itself with the attractive display room opening on the street shown in the left-hand picture. Its shop facilities were much enlarged. At the right a huge candelabra under construction.



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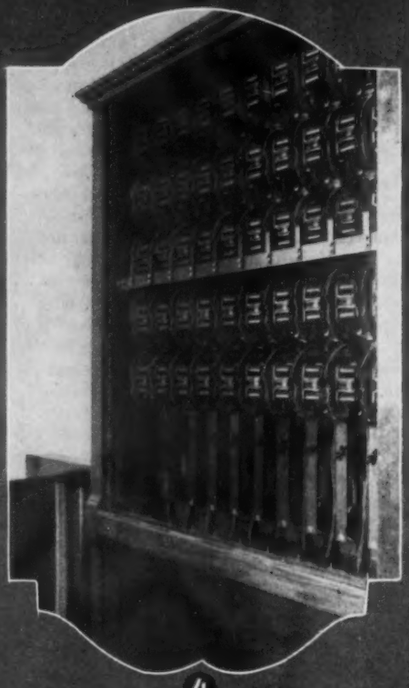
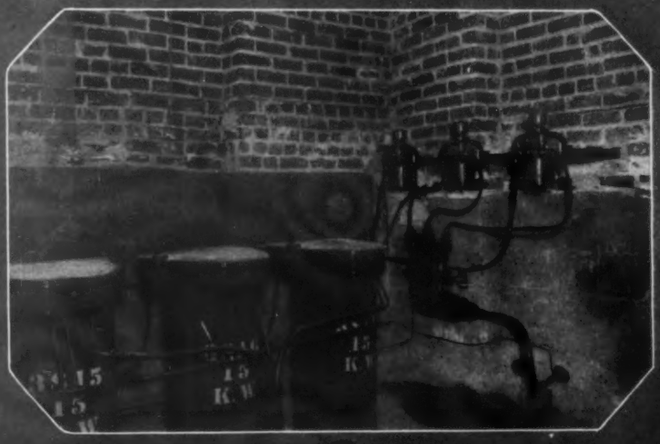


4

Sacramento State College Electrified

Some of the building's electrical features, explained in detail on the following pages, are illustrated here.

5



6

In the physics lecture room a large station ammeter and voltmeter (*left*) give the class visible readings of experimental equipment on the table. (*Center*) A set of corresponding instruments, under the glass table top, and (*right*) the control plug panels at the back.

Installation Keyed to Modern School Needs

Sacramento Junior College Upholds Theory That Scientific Education Demands Electrical Facilities in Keeping With Present-Day Progress

PRESENT-DAY developments in electricity give the technical school which teaches its fundamentals and principles a stiff pace to follow in its race to keep up with the march of events. This would not be cause for concern if it were not for the fact that schools are built to last a long time—from funds which may or may not be adequate—and seldom under a progressive civic policy that provides for improvements and additions designed to keep them in pace with the times.

At the Sacramento Junior College the rarer and more far sighted policy seems to have been adopted. Thus whatever changes field developments may bring, the installed equipment is sufficiently flexible and capable of expansion to keep this institution in pace with progress.

From the first, several years ago, close co-operation has been maintained between the architects, Dean & Dean of Sacramento; the electrical engineers, G. M. Simonson and Robert L. St. John; the principal, J. B. Lillard; the instructors in physics, Clarence Nash and Warren Grayman; and the electrical contractors, Maynard Cannon, superintendent for Latourette-Fical Company.

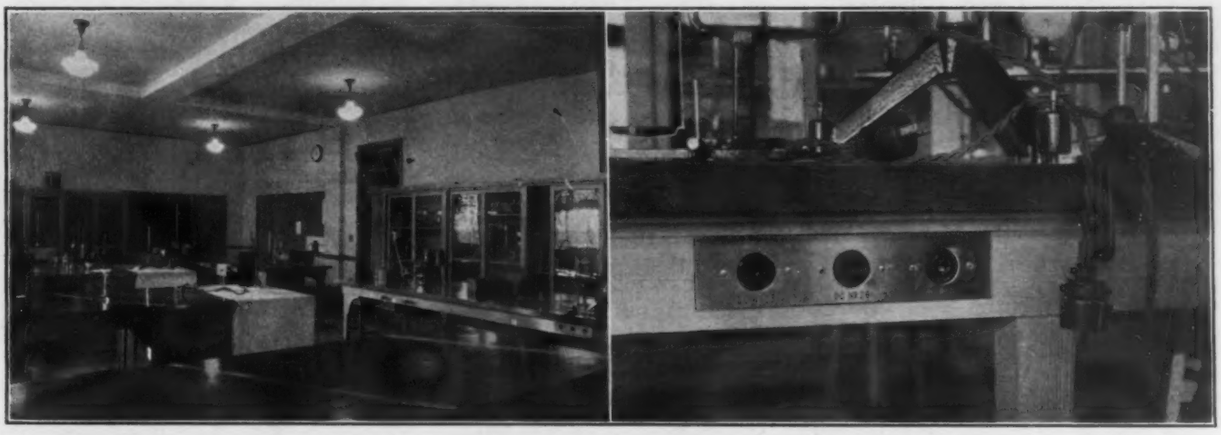
Laboratory Equipment a Feature

It is in the equipment layout for the classroom and laboratory uses of electricity that this school is most unique, although all features are of interest. And yet with the exception of the experimental switchboard, designed and built for the school, practically all equipment used is standard equipment of standard manufacturers and hence easily replaceable.

The experimental switchboard, in a room adjacent to the laboratory, is designed for control of supply of both a.c. and d.c. to all experiment benches or tables in laboratories and classrooms. One-half of the board is for d.c., being supplied by a 96-cell storage battery, arranged so that the cells may be connected in multiple or in series for various voltages needed. The first panel, upper portion, contains switches for this parallel or series connection of the storage cells. Below these are a series of plugs associated with these circuits. The next upper portion of the panel contains switches and fuses for each table circuit. Below are plugs associated with them. Thus by means of connecting plug wires, with positive and negative plugs of different sizes, to prevent mistakes, combinations giving required voltages may be set for any particular table or desk. There are 48 of these d.c. circuits, each labeled to correspond to its table outlet. Two of these d.c. circuits are provided for each table, as shown in an accompanying illustration.

Pictures on the Facing Page Explained

OF GENERAL electrical features, outside of the laboratory and classroom, the Sacramento Junior College has many. On the facing page (1) shows the street front elevation of the buildings, floodlighted at night by projectors set in niches in the two wing buildings, as shown in (2), and directed across the campus. Similar lights at the rear of the gymnasium building light the main building and in like manner the gymnasium is lighted from the main building. The main transformer vault (5) located in the gymnasium building is provided for future expansion. Its main switchboard (3) may be seen at extreme left of (5). Each building has its own vault, that of the main building being shown at (6). In (4) is shown the automatic telephone contactor board.



General view of a physics laboratory showing lighting. At extreme right may be seen one of the three-outlet plates on a table edge.

Three outlets for experimental work, the two d.c. requiring a polarized plug, the a.c. an ordinary "T" outlet; each circuit labeled.

Switchboard, front and rear, and storage battery for experimental work. The first panel of the board contains switches and plugs for parallel and series connections of storage cells and below these the plugs for table outlets associated with them. The second panel contains switches for fusing each d.c. table circuit. The middle panel contains instruments, m.g.-set starter, field rheostats, time impulse circuits and charging rheostats. The last section is the a.c. section providing taps on primary to maintain required voltage at the tables.

The other end of the experimental board is arranged to provide from 2 to 124 volts a.c. by switching of circuits controlling primary taps to any one or more of the 24 tables or desks. Plugs by which to make these connections on the a.c. side are likewise different and color-coded to prevent mistakes.

The center panel of the board contains instruments, charging section, start and stop buttons for the motor-generator set, field and charging rheostat control handles and lecture-room main switches. A particular feature is found in plug taps on both a.c. and d.c. connected to a time impulse relay operated from the second beat impulse of the master clock system by which these time impulses may be imparted to any circuit in the laboratory.

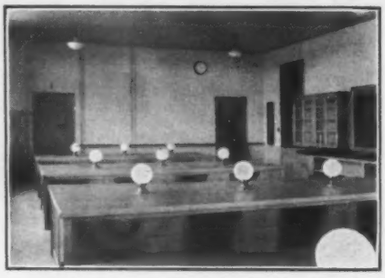
In the physics laboratory, as previously explained and illustrated, the student may avail himself, by means of polarized plugs on d.c. circuits and ordinary convenience plugs on a.c. circuits, of the kind of energy necessary for his experiments, preset by the instructor on the main panel to supply his particular table.

The lecture room also avails itself of modernity. A small panel at the rear of the lecture desk, illustrated herewith, gives remote control of the motor-generator set, and enables the instructor to plug in on any circuit and read its voltage. It also provides necessary connections for experimental equipment by means of coded and identified plugs. To make the readings visible to the class two 36-in. station instruments, with dials illuminated from behind, one an ammeter, the other a voltmeter, are set on the wall above the blackboard.

The voltmeter gives readings either of from 0 to 3, 0 to 15, or 0 to 30 volts. The ammeter gives readings of from 0 to 1.4, 0 to 28 or 0 to 140 amp. Associated with these instruments but capable of separate operation are master volt and ammeters set in a niche, covered by plate glass, under the table top and visible to the instructor. (See illustration.)

Ventilating fans, a vacuum pump and air compressor are also provided the laboratories. Each table is supplied with air, gas, vacuum and the electric circuits already described.

The dark room for photography is equipped with two ruby lamps, two amber and one white at the ceiling, and its table with one white and one red lamp under glass for printing. Research laboratories also have radio and



In botany and biology laboratories 60-watt lamps in 8-in. R.I. balls on the tables give light for examination of specimens.

three-phase plugs. Biological and botany laboratories have 60-watt lamps in 8-in. R. I. balls, four to a long table, for the examination of specimens and to aid in miscroscopic work.

Lighting throughout the buildings is accomplished by semi-indirect bowl units. An exception is made in the art department which is illuminated entirely by indirect lighting. Sterioptiocon plugs are available in all lecture rooms and telephone plugs in all offices.

Exterior Floodlighting Control

The building exteriors are floodlighted by means of five 1,000-watt projectors set in niches as shown in an illustration. The main building is flanked on each side by a secondary building. It is in the outer walls of these facing toward the main building that the floodlights are directed to cover the front of the building. A floodlight on the rear of the main building lights the gymnasium building at the rear. The rear of the main group of buildings likewise is lighted by two floodlights on the roof of the gymnasium building.

All these floodlights are controlled by a time switch on a single circuit. A pair of wires of the telephone cable operate relay circuits, making it necessary only to install a few feet of wiring on the lighting circuit to take care of the floodlights by means of a 110-volt, 60-cycle relay (corresponding to about 24 volts d.c.).

Main service comes in to the main transformer vault located in the gymnasium building at 4,000 volts. This building is about 350 ft. to the rear of the main building group. Therefore a branch is taken off underground to the transformer vault in the main building, coming in at 4,000 volts here also, each building having its main switchboard with an oil main service switch of its own. The distribution system is a three-phase, four-wire system, fed from the transformers with star-connected secondaries.

All buildings are equipped with autophone automatic selecting phones, a master clock system and storage batteries and charging units for each.

Combined Stage and Gymnasium

Ingenious is the only term which describes the arrangement whereby the gymnasium is also made to serve as an auditorium. This is accomplished by having the girls' gymnasium floor on a higher level than that of the boys' gymnasium, so that by the folding back of a partition the girls' portion becomes the stage and the boys' portion the auditorium.

Thus by providing a small panel board in one wall, footlights which are boxed in when not in use, and two sets of border lights which can be removed from danger of breakage when the floor is used as a gymnasium, the girls' por-

tion of the building makes a very acceptable stage. This has been proved in a number of successful performances given there.

A moving picture booth, behind the wall in the boys' portion, is equipped with a motor fed and operated mirror-arc moving picture projector. A signal system to orchestra light outlets, and remote control of house and stage lights through momentary contact switches, is provided at both stage and booth. Each color circuit in the footlights has an individual plug connection to prevent mixing of circuits.

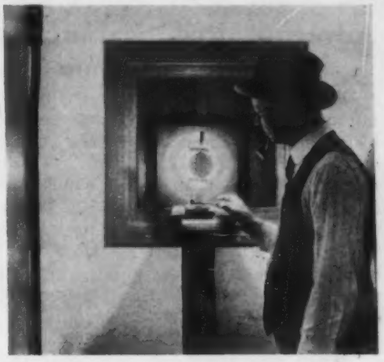
By popular subscription a new stadium of 35,000 seating capacity was built at the rear of the junior college, making its facilities available to the athletes from that institution as well as providing a field for the city's major athletic and field events. This too was designed by Dean & Dean, architects of Sacramento, and its electrical installation planned by G. M. Simonson. Chris Snyder was consulting structural engineer. Scott Electric Company of Sacramento made the installation.

A feature of this job is that it is wired throughout with heavy-duty plugs for provision of night lighting for spectacles. Twenty-two three-wire circuits of No. 8 wire, each capable of carrying 35 amp. at 210 volts, enough to provide 7,500 watts of lighting per circuit, are installed. The plugs are each of 60-amp. capacity, in a watertight box.

Three sets of distribution panels, by which the buses may be split, give remote control of the entire lighting for pageants, etc.

While this Sacramento school installation has features which distinguish it from any other similar educational plant, it typifies the care and the thought that is being given to the problems of making facilities available to present-day students for the most complete grounding in electrical fundamentals.

Enlarging Camera Device



An efficient enlarging camera was built for the San Francisco Chronicle by means of a 1,000-watt, 120-volt lamp placed 14 in. behind a 10-in. condenser, focused on a ground glass and a 5-in. condenser. It was set up in a room adjacent to the enlarging room in a recess in the wall which kept all light from the enlarging room. Strong light for fast printing was provided by this means. A 75-watt lamp in the same optical train was provided for focusing before turning on the strong light. Switches in the dark room gave control to the photographer.

"Unbreakable" Lamp Post Given Shock Tests

The surprisingly high cost of replacing lamp posts in large cities due to breakage by auto accidents has brought about the development of a lamp post that will withstand unusually severe impacts. A post was publicly tested on Oct. 23. Several blows of 85,000 lb. were delivered before this Hollowspun post was broken. An automobile driven at approximately 30 miles an hour was completely wrecked against one of these posts, the only damage suffered by the post itself being an abrasion caused by impact with the front axel of the car which had been twisted back as far as the driver's seat.

A feature of this post is that even after a most unusual blow which may break it the post remains standing because of the rail steel inside reinforcement, thus avoiding the added danger of a heavy post falling on passengers within a car or on pedestrians.

Single Bank of Floodlights Illumines Shoshone Falls

SPECULATION as to how the remarkable floodlighting of Shoshone Falls on the Snake River in Idaho, illustrated in the frontispiece reproduced in Electrical West Aug. 1, 1928, p. 66, was accomplished, will be ended by the description of the installation given by the Idaho Power Company. A concrete and steel structure was fastened to the face of a narrow promontory of rock which jets out precipitously to the water's edge over the turbulent pool and across the river from the falls. The first workmen were let down on ropes so that footings could be cut into the rock for the concrete foundation. The top of this structure was made into an observation platform from which visitors may view the falls at night or during the daytime. Below the platform may be seen in the left-hand picture below, the battery of thirty 1,000-watt Pyle floodlights trained on the falls. The right-hand picture shows the placing of two upper rows of floodlamps on the framework.

The lamps project a rectangular beam of light whose beveled beams are joined to give a uniform distribution and intensity of light over the waterfalls. The structure is located on land belonging to Frederick J. Adams of Omaha, Neb., who gave the Idaho Power Company use of the property for the purpose. The floodlighting was provided and turned over to the State of Idaho by the company in a spirit of state pride. The method of installation used is adaptable to other like jobs.

Louvers for Island Windows

For the island window lighting has always been a problem because the person looking at the window may view it from all sides, and the usual type of unguarded reflector invariably comes in the line of vision and causes a glare which detracts from the display of merchandise in the window.

To overcome this condition an ingenious trough lighting fixture has been developed by The Litcraft Organization which employs louvers on both the horizontal and vertical planes. The louvers allow all possible light to fall directly below the reflectors. However, they are effective in cutting off direct vision of the lamps themselves in all positions except directly under the reflector.

The "spilling" of light against the sides of the louvers also tends to diffuse and distribute the light flood over the window area. The picture shown above was taken at The Emporium, San Francisco, whose windows were recently rebuilt with this equipment. Barker Bros., Los Angeles, also make use of such equipment for their large furniture-display windows.

Advertise Red Seal in the Want Ad Columns

Directing its attack upon the home buying market at the point most sought by those interested in buying property, the Electrical League of Colorado recently started a program which has considerable promise of success. In the classified advertising pages, under the "For Sale, Real Estate, Improved" heading in both Denver papers, several three-line advertisements are to be run daily.

The copy is to read as follows:

"When you move, be sure that the new home is wired properly. Look for the Red Seal, the national standard for house wiring."

"How about the wiring? Will you be able to use appliances and portable lamps in every room? Look for the Red Seal emblem."

These are to be run as what are known as "space holders." A minimum of three lines daily must be used to take advantage of the special low rates offered by the newspapers for this classification.

The league feels that, small as they are, these little messages will encourage the prospective home buyer to look over the electrical layout more carefully and come to demand it before signing the contract.

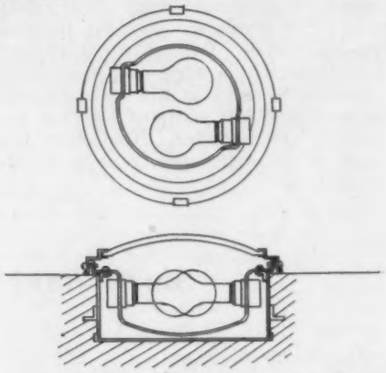
Another feature planned by the league in this connection is advertising without cost to the builder of each new Red Seal home built for a certain period of time, telling in the advertisement its electrical features.

Shield Lights for Insane Wards of Hospitals

Because demented patients are prone to break light bulbs the problem of keeping light in insane wards of hospitals has proved difficult. A simple method to protect the lamps and still provide general illumination has been worked out as shown in the accompanying diagram.

The lamps are held in place by sockets mounted on a heavy metal reflector pan. Over the lamps are clamped a heavy metal frame containing a special wired glass plate, as shown.

This method has been successful in preventing damage to the lamps in several hospitals where it has been installed.



Of similar design is a night light used in hospital wards. In the latter, however, a smaller lamp is used in a square box, inset in the wall about a foot from the floor to be out of the line of vision of the patients on the beds.

Pipe Layout in the Blower Exhaust Installation

Difference in Exhausters and Type of Material to Be Handled Call for Knowledge of Fundamentals Before Making Job Layout

By J. R. WILSON*, Quality Electric Works, Los Angeles.

Electrical Estimating Series—XLII

BLOWERS and exhausters are adapted to an extensive variety of uses. In design, blowers and exhausters are very similar, the principal difference being in the arrangement of the bearings. Blowers usually have two inlets and a bearing on each side with arrangement for attaching piping to the discharge side only. Exhausters usually have both bearings on one side with a single inlet on the side opposite the bearings. They are arranged for attaching a pipe to both inlet and discharge, so that air may be drawn into the exhausters, as well as discharge from them.

Blowers are used generally for supplying forced draft to furnaces where not over 6-oz. pressure is required. They are also used for ventilating mines through long runs of metal piping or flexible tubing. Exhausters are used for removing smoke and gases, removing dust, hot air from furnaces, steam from vats, and other similar uses. It is possible to use an exhauster when a blower could be used equally well.

An exhauster may be used in most cases, but it is not possible to use a blower in place of an exhauster. Whenever in doubt an exhauster should be used. Usually the price, capacity and power are the same for either blower

* All rights reserved by the author.

or exhauster. For ordinary work the blast wheel for the exhauster is of the same general construction as the blower. Where stringy material is to be handled a special type of wheel is supplied on order.

Layout of Piping

In a typical job, after the number and size of branch pipes have been determined by Tables 1, 2, 3 and 4 (in the previous number), the next step is to make the layout of the main suction piping to the exhaust fan. Use as few elbows as possible, and design each elbow so that the minimum of resistance will be offered to the flow of the air through the duct. The curve shown in Fig. 1 will be found very convenient in designing elbows.

For woodworking machines a velocity of 3,600 to 4,000 ft. per minute is required to move shavings and sawdust effectively. If the exhaust fan is operated at a speed to give a corresponding pressure of 3 to 5 oz., the desired result will be obtained. Where this high velocity is maintained the friction in the piping is of much consequence, and the problem is so to design the duct system as to provide uniform suction at every outlet, with a minimum of friction and reasonable cost of materials.

A practical method to use in determining the size of the main pipe is: where two branch pipes join, add together their cross-sectional areas and choose a main pipe equal to the sum. The process should be continued back to the fan until each and every branch has been provided for in the size of the main duct. The diameter of the fan inlet should of course correspond to the size of the main duct. Where low power cost is of more importance than economy of installation cost the sizes found by the above method should be exceeded. This will reduce the friction losses and result in an economy of power consumption.

Determination of Friction

The formula for the flow of air in smooth circular metal pipes is approximately as follows:

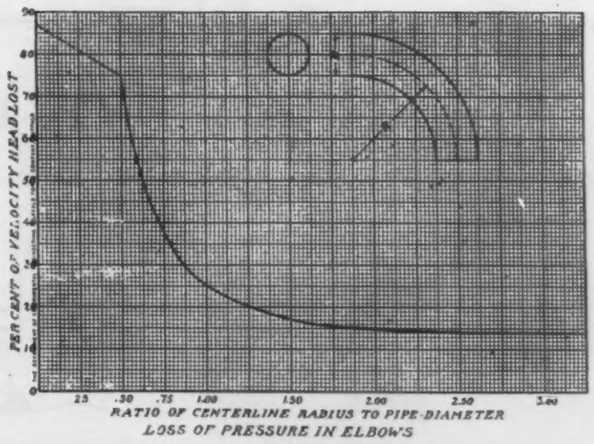


Fig. 1. Combination chart showing ratio of center line radius of pipe duct elbow to pipe diameter, as well as graph of pressure loss in elbows.

$$F = \frac{1}{55d}\left(\frac{V}{5273}\right)^2$$

where:

F = loss of pressure in oz.

V = velocity in feet per minute.

l = length of pipe in feet.

d = diameter of pipe in feet.

(i.e. $\frac{l}{d}$ = length of the pipe in diameters.)

From this formula 55 diameters of the smooth pipe produce a loss corresponding to the velocity head. In a 12-in. pipe 55 ft. long, or a 24-in. pipe 110 ft. long, loss in pressure will correspond to velocity. Therefore, 4,000 velocity will cause a loss in pressure of 0.576 oz. This is approximately 1-in. water gage every 55 diameters. Table 6 gives pressure losses at different velocities.

Elbow friction is of great importance in any duct system and the correct design of any necessary eblows will determine largely whether future operation economy is to be realized. When figuring friction loss it is customary to consider an elbow as being equivalent to 10 diameters of pipe. It has been the general impression that the more gradual the sweep of an elbow the less the friction loss.

Prominent engineers have proved this to be an erroneous theory, and have shown that there is no real advantage in making an elbow radius over 1½ to 2 times the diameter of the pipe. In using the curve given in Fig. 1 assume a 12-in. pipe with an 18-in. radius to the center of the pipe, or a center line radius of 1½ times the pipe diameter. The corresponding friction loss is 0.17 of a velocity head for smooth round elbows.

Table 6

Diam. of pipe in inches	Area in Sq. inches	PRESSURE LOSS IN INCHES OF WATER, DUE TO FRICTION OF AIR, PER 100 FT. of pipe. VELOCITY OF AIR IN FEET PER MINUTE														
		200	400	600	800	900	1000	1200	1400	1600	1800	2000	2400	3000	4500	6000
3	7.0	.023	.092	.208	.370	.468	.581	.832	1.14	1.48	1.87	2.32	3.33	5.20	11.70	20.80
4	12.5	.017	.070	.157	.280	.350	.440	.624	.862	1.12	1.40	1.76	2.50	3.94	8.85	15.76
5	19.6	.014	.056	.125	.226	.281	.348	.498	.721	.902	1.12	1.39	1.99	3.12	7.03	12.48
6	28.2	.011	.046	.104	.185	.234	.290	.417	.568	.741	.935	1.16	1.67	2.60	5.84	10.40
7	38.4	.010	.040	.089	.158	.201	.249	.357	.487	.633	.805	1.00	1.43	2.22	5.01	8.88
8	50.2	.009	.034	.078	.138	.176	.218	.312	.427	.554	.703	.872	1.25	1.95	4.38	7.80
9	63.6	.008	.031	.069	.123	.156	.194	.277	.379	.493	.625	.776	1.11	1.73	3.89	6.92
10	78.5	.007	.028	.063	.111	.141	.175	.250	.342	.445	.562	.700	1.00	1.56	3.51	6.24
12	113.1	.006	.023	.052	.092	.117	.145	.208	.284	.369	.467	.580	.832	1.30	2.92	5.20
14	153.9	.005	.021	.049	.086	.109	.136	.194	.266	.345	.437	.544	.776	1.21	2.74	4.84
16	201.0	.004	.017	.039	.070	.088	.109	.156	.214	.278	.352	.436	.624	.977	2.20	3.91
18	254.4	.004	.015	.035	.060	.078	.097	.138	.190	.242	.312	.387	.552	.867	1.95	3.47
20	314.1	.004	.014	.031	.055	.070	.087	.124	.170	.221	.280	.348	.496	.778	1.75	3.11
22	380.1	.003	.013	.028	.050	.064	.079	.113	.156	.202	.256	.317	.452	.711	1.60	2.84
24	452.3	.003	.012	.026	.046	.058	.073	.104	.142	.164	.234	.290	.416	.650	1.46	2.60
28	615.7	.003	.010	.022	.040	.052	.062	.089	.122	.159	.202	.249	.356	.558	1.26	2.23
30	706.8	.003	.009	.020	.037	.047	.058	.083	.114	.148	.187	.232	.332	.520	1.17	2.08
36	1017	.002	.008	.017	.031	.039	.048	.069	.095	.123	.156	.193	.276	.433	.976	1.73
42	1385	.002	.007	.015	.026	.033	.041	.059	.081	.106	.134	.166	.236	.371	.836	1.48
48	1809	.002	.006	.013	.023	.029	.036	.052	.071	.092	.117	.144	.208	.325	731	1.30
54	2290	.001	.005	.012	.020	.026	.032	.046	.063	.082	.104	.129	.184	.288	.650	1.15
60	2827	.001	.005	.010	.018	.023	.029	.042	.057	.074	.094	.116	.168	.260	.585	1.04

NOTE:—For other lengths of pipe the loss is directly proportional to the length.

Size of Fan

There is no resultant saving in power in using a fan larger than the determined main duct size indicates. A fan should be chosen whose inlet is the same size as the main duct. When using a larger fan than necessary for the system only 50 to 75 per cent of the fan capacity is utilized. True, the speed may be a little slower, but a properly designed fan operates at highest efficiency at full capacity.

The cost of power is the determining factor in the choice of a standard fan or a slow-speed, high-efficiency fan. Where a mill generates its own power, through refuse-fired boilers, cost of power may not be of prime importance and a standard fan will be satisfactory. However, most modern mills purchase their power from a public utility, and power cost is a factor to be considered.

Also, the extra wear and tear of high speed operation should receive consideration. High efficiency fans save from 15 to 50 per cent in power and operate at a one-third slower speed than standard fans. In every instance the added initial cost will prove to be an excellent investment. Where it is necessary to handle long shavings or stringy materials a special, non-clogging type of cone wheel should always be used. Where bulky materials are to be conveyed it is essential to use a type of extra heavy fan.

Better Merchandising

Modern chimneys what they are, Santa Claus has taken to electric reducing—thereby setting an example which should sell many of these devices this year.

New Christmas Markets

Why They Are New—

NEW devices open up new markets. New uses for established appliances and fittings are evolved. Even the old tried and proved appliances come out in new colors, new designs, with new appeal. Whatever the device, new customers for it can be developed, people who never before have bought electrical gifts or decorative material, people inspired to do so by their neighbors and friends this year as never before.

Reducing—Electrically

TAKE health machines for instance. Each year brings its electrical medicine machines. First it was violet ray—still going strong. Last year it was "horse collars," the magnetic coils of wire that were to "ionize" the iron in one's blood. This year health goes into harness. With more sense, and no less dollars, there are the many kinds of reducing and massaging machines, such as that Santa Claus is pictured using above. Real ultra-violet light lamps, either with carbon arc or mercury varpor in quartz, are becoming a market demand.

Decorative Lighting—Stores

FLOODLIGHTS and spots find increasing use at the Christmas season. Stores of every kind will use them more than ever this year. Festoons and stringers of lights, colored lamps of all kinds, interior and exterior tree lighting, flashers and twinkling sets, color screens and color changer apparatus should all sell.

All kinds of stores can be sold Christmas decorations both for interiors and exteriors.

Streets

Whole towns are stringing lights of red and green from pole to pole throughout the business districts. Sell community merchant groups, service clubs, civic leaders and city officials on this decorative festival lighting. Sell red and green natural color lamps—up to 300 watts are now made—for street lighting units. Sell flashers and twinkle sets for community trees.

Homes

Christmas candles burning in all the windows of town, exterior trees lighted, interior festoons and tree lights, floodlights for exteriors—these can make cheer and increase business this season.

Toys and Tools—

THE never ending source of joy to small boys, electric trains appear this year with new features—power stations and signal devices, special tracks, too. Newcomers include electric motor-drive airplanes, speed-burning auto racers, spinning tops, musical chimes, and new electrically heated steam engines of many kinds. For little girls the tiny electric range that really cooks, the baby electric iron, toy washers and vacuum cleaners are available to the electrical merchant who would make his store "electric toy headquarters."

Tools, too, for home use for boy or dad, saw outfits, complete electric wood shop, buffers, drills, spray outfits and mixers all can be sold as never before.

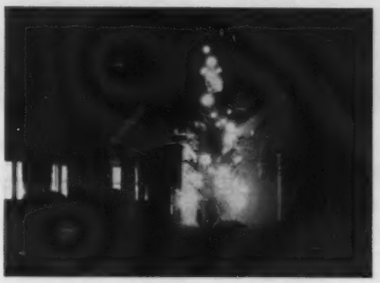
Christmas lighting contests stimulate sales of decorative lighting.

Home Appliances, New and Old

STANDARD lines, like refrigerators, ranges, heaters, washers and vacuum cleaners still make big holiday gift appeal. New colors, new features, make selling easier. Small hand vacuum cleaners and miniature washers can be sold in homes already having the bigger appliances, as auxiliaries or for special uses. If the motor-car men look to see two cars in each family, why not two washers, two or three cleaners.

Which is saying nothing at all for the new appliances, new mixers, dishwashers, doughnut makers, water-bottle warmers, corn poppers, egg cookers, milk warmers and new types of all old lines.

Several new automatic features on toasters, waffle irons and percolators make excellent selling points. Together with more active advertising, store decorations, windows which pull, and little personal service items as to deliveries and wrapping and mailing, these Christmas lines in electrical merchandise should be made to dominate in Christmas giving. Every other type of merchant has profited by the use and sale of electric lighting and appliances. The electric store can do likewise.

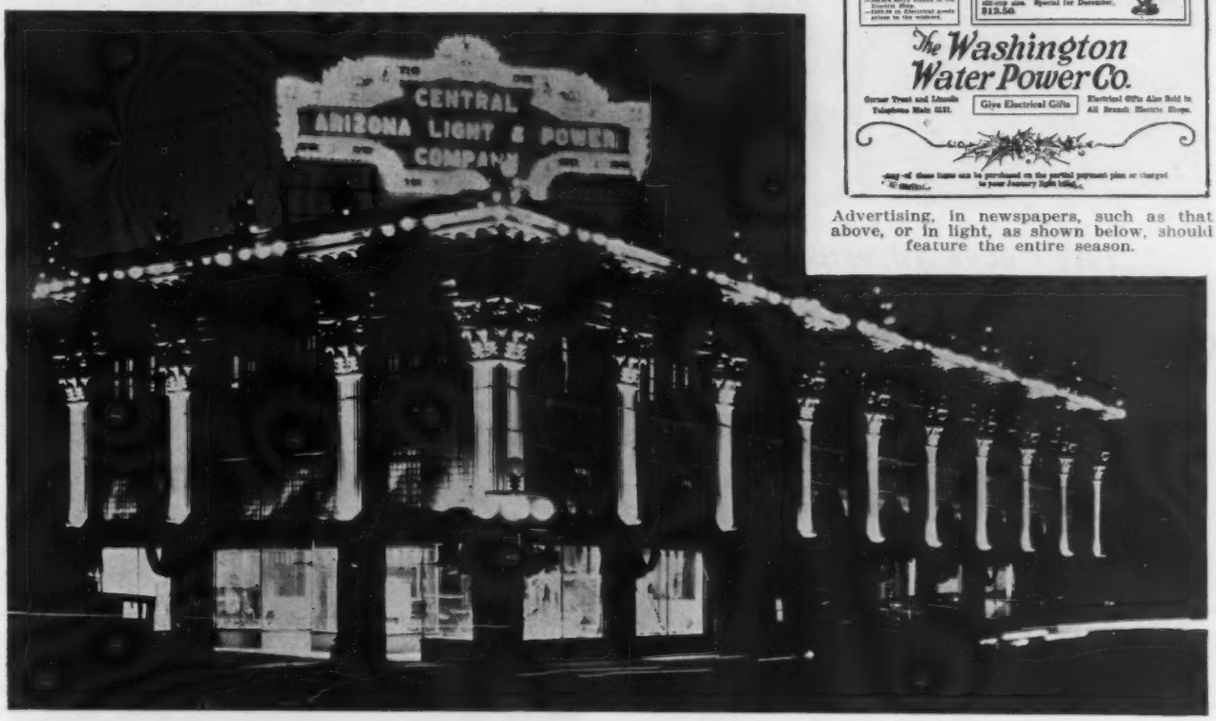


Homes anywhere can use tree lighting sets of the new multiple, 110-volt type intermediate base lamps.

Santa Claus will fill the Christmas "sock" of the electrical merchandiser who takes full advantage of all new market-building appliances and the new features of time-tried established appliances.

Electrical Christmas Gifts
of the Better Quality
Useful -- Lasting -- Appropriate
The Electric Shop is ready to supply you with just the kind of Christmas gifts you like to give and receive.
Electrical appliances of the better quality are so easy to choose and so sure to please.
Let us suggest that you make your selection now while assortments are at their best.
Curling Irons for the Up-to-Date Miss
Electric Irons
Electric Air Heaters
Electric Toasters
Electric Urn Sets
Waffle Irons
A Warming Pad for Grandpa or Grandma
Christmas Tree Lights
December Special
Hotpoint Electric Percolator
TRENTON DESIGN
$12.50
Join the "Christmas Cheer" Lighting Contest
The Washington Water Power Co.
Gives Electrical Gifts

Advertising, in newspapers, such as that above, or in light, as shown below, should feature the entire season.



Before and After in Drug Store Lighting

In the town of Lancaster on the Southern California Edison system, Haubrich's Pharmacy had been doing business for a great many years. An Edison lighting specialist dropped in on him and suggested that he could improve the general appearance of his store and at the same time increase his business, if he would make certain changes in his lighting facilities.

Mr. Haubrich was agreeable and the "before and after" pictures show the story graphically.

In the original installation there were four 150-watt lamps. In the new layout there are six 200-watt lamps in 14-in. enclosed glass globes. Needless to say the new improved lighting system changed the entire merchandising look of the store and more than paid for itself in increased business. At the same time, the central station benefits by the increased load resulting from the new lighting equipment.

Tire Cover Advertising is Silent Salesman

CAPITALIZING upon the advertising space offered by a tire cover, 250 San Joaquin Power Company automobiles now carry tire covers as shown in the photograph. It is hoped with this form of advertising to establish a few of the outstanding features of electric cooking.

Necessarily the message must be brief. Therefore it is limited to some such caption as "Special Cooking Rate," "Economical," or "Clean and Cool."

These cars with their tire covers become silent salesmen and act as constant reminders of the service the company is offering for sale. They also act as a means of identification of the salesman. It has been found that the men are taking particular pains to see that their cars are parked where the signs will be most conspicuous. This naturally adds to the value of an advertising medium.

This method of advertising is one of the best means of bringing the message to the rural population. Power company cars traverse practically every section of the territory served by the company no matter how isolated it may be.

The copy on the cover is kept brief, the design and color scheme are designed to gain the most in readability.

Quantity prices on the making up of these tire covers have been obtained and it is planned to change the copy by changing tire covers at regular intervals.

Street Car Display Develops Range Prospects

Following its success in acquainting the public with electric refrigeration by displaying a machine on the front vestibule of one of its street cars, the El Paso Electric Company is displaying an electric range in similar manner. One seat is temporarily removed and the range placed near the center of the car with suitable card setting forth the advantages of electric cooking. One car on the system carries the display for a month during which time the car is routed over all of the lines in order to reach all street car riders.

It has been found that a number of electric refrigerator and range prospects are developed by such displays.

Lighting equipment display room, with cosy, homey atmosphere. Stock not on display is kept out of sight behind heavy drapes seen at right.

Two rows of sockets, in which burn 25-watt lamps, are used to light up the glassware and show how it will appear under home conditions.

A Santa Rosa Merchandiser Who Has Statewide Trade

H. W. Jacobs' Method of Displaying Lighting Glassware Gives Customer Best Possible Impression of How It Will Appear In Actual Use

SANTA ROSA, Calif., boasts of a lovely garden a whole block square, from which the late plant wizard, Luther Burbank, gave the world horticultural creations. This little city of 12,000 population also takes pride in many other productive achievements.

Not the least of these is an electrical store of which any city might be proud, one which holds the distinction of having sold and retained the lamp contract for the entire Bank of Italy chain of banks covering the entire state. This store is run by H. W. Jacobs, pioneer electrical man in that city.

Each year the Christmas tree on the sidewalk at its front door attracts to it a large volume in holiday trade. Its well lighted windows are a sales feature which keeps up volume during the year.

Department store methods are used to advantage. There is a radio section of the floor, near one entrance. A range and air heater section faces it on the other side of the floor. Illuminated show cases, some of them visible from the street over the short curtain at the back of each window, give brilliance to appliances displayed in them. The central portion is surrounded by these show cases, forming the only partition to the office, which consists merely of two desks accessible and in view of everything.

Although small, the storage room for lamps and parts and repair work is so well organized that a large stock is immediately available on floor or mezzanine.

The features of the special lighting fixture display room are illustrated here. Wicker furniture for coziness, attractive drapes to conceal the glassware and fixture stock shelves, and more unique still, the lamps over which glassware may be placed easily and lighted up from within, bringing out colors and designs as no other method can.

A mezzanine floor and well planned shelving make the small storage room at the rear earn every inch of floor space in storage of stock, parts, lamps and a short work bench for repair on appliances. Space is even found for assembly and spraying of fixtures.

Attractive display floor and well lighted windows are evident here.

McRae's and Hendricks, 1928 edition, contains as usual an inexhaustible supply of up-to-date buying information. The present edition, however, in spite of its 2,632 pages, is in compact size (8½ x 11 x 4½ in.) and can be handled comfortably on the buyer's desk. The address section lists alphabetically approximately 75,000 manufacturers, their home office addresses and, in many instances, local distributors. The classified material section gives approximately 18,000 different kinds of material, equipment and supplies. Manufacturers are listed alphabetically beneath each classification. In the back of the book is a trade name section listing approximately 75,000 products together with the manufacturers thereof.

Breakfast steaming hot.

"Electricity is Cheap—Use More of It"

In the series of three-minute talks which ELECTRICAL WEST has been publishing each month since they were delivered in the contest conducted at the P.C.E.A. convention at Pasadena in June is that of Miss Winifred Boole of the San Fernando Valley district of the Southern California Edison Company. Miss Boole's talk was awarded honorable mention, and contains excellent arguments for the use of electricity for many of the tasks performed in the home.

A great cry.

WE WHO are living in the great Twentieth Century enjoying the comforts of fine motor cars, huge ocean liners, large roomy well equipped aeroplanes, find it somewhat difficult to understand just how our grandmothers and grandfathers managed without these things. We who look on them as absolute necessities and mere comforts, find it even more difficult to think back to the days of oil lamps and gas illumination in the home. We cannot conceive of bending over hot cook stoves and facing huge wash tubs and a full day of ironing while waiting for the irons to heat on the stove.

Today sees the modern woman arise and in no time with the aid of an electrically equipped kitchen place breakfast, steaming hot and nourishing, before the other half of the house. A little later on the electric washing machine soon has the weekly wash completed and perhaps toward noon the modern woman seats herself before her ironer and lets it do the hard tiresome work for her.

With the aid of an electric vacuum cleaner the modern home is always immaculate and sanitary. The modern woman herself is far healthier today than in the days of the mop and broom, when so much of her vitality was completely drained from her.

People complain of the high cost of electric appliances. "We can't afford a refrigerator" is a great cry from the majority of people. Why, they cannot afford to be without one! Is not the proper preservation of food, after all, a vital necessity? Electricity is so ridiculously reasonable in California and all along the Western Coast. In some of the Eastern states where the rates are high one might have some excuse, but here in the West no home should be without these wonderful labor and health saving devices.

Evolution goes slowly but surely on and with the passing of a few years one will find the majority of homes equipped throughout with electricity. Our slogan, "Electricity is Cheap—Use More of It," now mostly theory, will be a positive reality in our American homes.

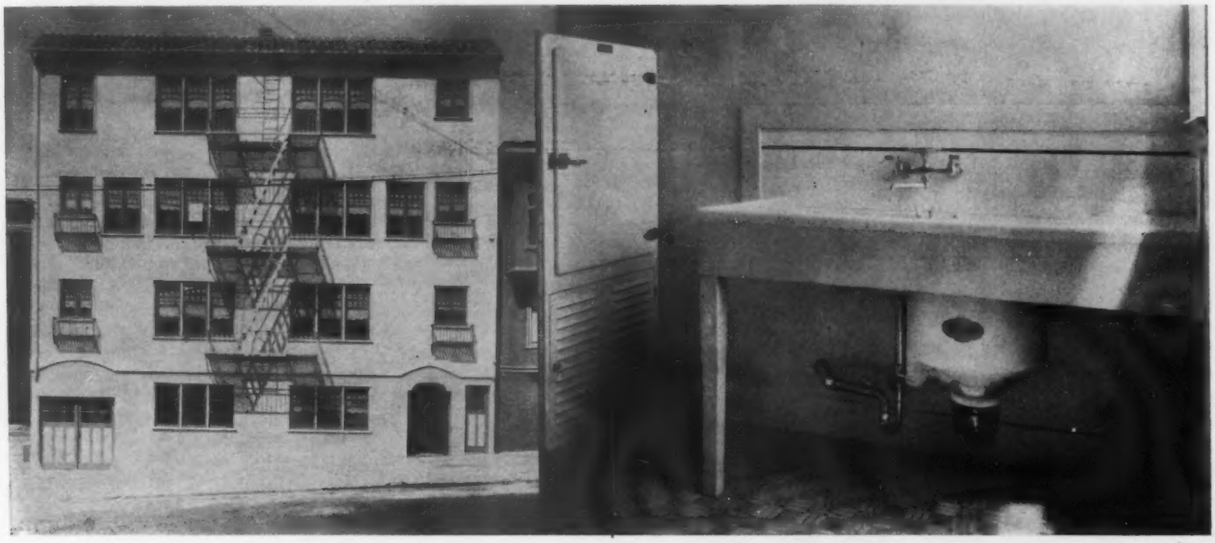
Sold $50,000 in Dishwashers in Four Months

MORE than $50,000 in dishwashers within a period of less than four months has been the record of L. E. Kincaid, Electragist of San Francisco, who is distributor for the Walker unit in northern California. Most of these dishwashers were sold in blocks to apartment buildings which, Mr. Kincaid says, will become the leaders in introducing this electrical servant into American home life.

One job, the Chrisman Apartments on Arguello Blvd., San Francisco, an all-electric, Red Seal building, illustrated below, started off with thirteen units. Another came along with 48 dishwashers. Another group of four apartments was equipped with 192 dishwashers and another with 55.

In new homes and bungalows, too, installations have increased in the past few months, Mr. Kincaid says, showing that the time is arriving when the electric sink will become as popular as the refrigerator and range.

The complete electric sink has found a better outlet through plumbing than electric channels in the past. The production of a portable model, on casters, with enamel table top and occupying a space only 24 in. square, using only 3½ quarts of hot water and hence needing no sewer connection, will open the field for electrical merchants in the sale of dishwashers. Such a machine is now being placed on the market for contractor-dealer and other merchandise outlets.



Mr. Wilson (bareheaded, at center) makes national events bring crowds to his store.

The Suburban Can be Made Paying BUSINESS

By Hugh A. Wilson
Wilson Electrical Shop,
Seattle, Wash.

ONE hears a great deal of talk of the expansion of department and chain stores, of their encroachments on the helpless specialty merchant. For enlightenment I wish some of the skeptics would visit our district, where they will find some of the finest and most prosperous specialty shops in the city of Seattle.

For the past twenty years my electrical shop has been located in the prosperous and growing University District in Seattle. The University District is a typical suburban community, and the problems of the merchant here are very similar to those of the dealer in suburban districts of other large cities.

Of course, the suburban dealer is expected to carry a variety of electrical merchandise and to render service on a par with that of the downtown store, but the problem principally is to get people into your store as often as possible. The average person does not hesitate to browse around in a department or downtown specialty shop, even if he has not the least intention to purchase. But it is very difficult to get a person into a suburban specialty shop unless he definitely intends to make a purchase at that store at the time. The suburban merchant who carries a full line of electrical merchandise will succeed in proportion to his ability to get people to come into his store as often as possible, no matter whether they have in mind to purchase at the time or not. For unless you get people to come into your store to see your merchandise and compare prices and learn of your service, the business that should be yours will go elsewhere.

In our district we have an active commercial club composed of and supported by the local merchants. We have set aside a fund to pay for an advertising campaign in the Seattle newspapers pointing to the advantages of buying in the University District specialty shops. Twice a year the commercial club promotes an "open house" event. It is a district holiday in the full sense. Store interiors are decorated in holiday attire, windows dressed up most attractively, interesting musical programs arranged, various forms of contests staged, and individual shopkeepers prepare to distribute souvenirs and to add what they can to the entertainment features.

During the "open house" event no effort is made by the merchant to sell merchandise—he simply receives the district folk as friends and neighbors. In this way people who visit my shop in great numbers learn of our variety of electrical goods and we in turn are able to secure information on their needs of everything electrical. Each "open house" event usually results in a host of new customers, and other merchants in the district have the same experience.

We capitalize the neighborly spirit in every possible way. If there is a notable neighborhood event, such as a bazar, a political meeting, or any other occasion which requires a large gathering of people, I usually offer the use of one of our radio sets to afford additional entertainment during intervals in the respective program. Not only does this create a good deal of publicity for my shop but we manage in this way directly to boost radio sales.

We are right next door to the University of Washington, and when some great athletic event is being broadcast there is usually a big crowd in front of our store. When broadcasting the results of a football or baseball game we prepare for the event by installing a score board in front of the store. The crowd in front of my shop is so big that a path has to be cleared to permit people to enter the store. Yet it does not interfere with business at the time. People do not mind elbowing their way through the throng of good-natured college youths.

In case of rain during the broadcasting of an important athletic event or a political speech or news of national interest, I do not hesitate to open the door wide and invite the crowd inside the shop, moving display tables aside to make room for them. Just another way of getting people into the store!

Our repair department has been one of the most important means of bringing people into the store, and with all that it has proved profitable.

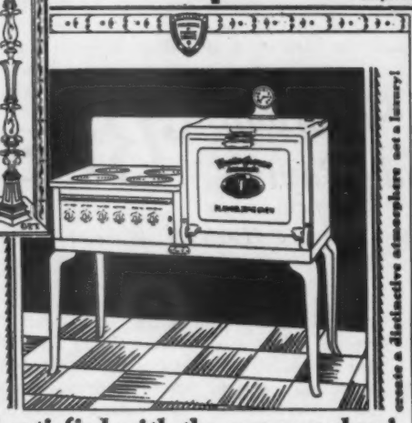
It is these small items that get turnover in the small suburban shop. We sell about five or six thousand dollars' worth of lamps alone during the year, and another item like storage batteries gives us about one turnover a week. Such small items are displayed on open racks, easily seen and handled by the store visitors. We change our store arrangement as often as we possibly can, always aiming to give an idea of the wide range of electrical merchandise carried in our store. We change our windows about every three days. When sending bills and statements to customers I stuff envelopes with manufacturers' advertising literature.

We do not operate a contracting department, but find it more profitable as a suburban store to specialize in alteration and extension work.

As a rule we do not make deliveries to customers' homes, but prefer that they call in person for their purchases. For one thing, we thus eliminate as much as possible the delivery overhead, something that the suburban merchant who must compete on a narrow margin of profit with the downtown stores must always consider. And you must remember that by encouraging people to call at the store for their merchandise you not only increase your chances of increasing sales per customer, but it is far easier to secure your collections.

Westinghouse
THE ELECTRIC RANGE WITH THE AUTOMATIC "FLAVOR ZONE" OVEN
YOU MUST SEE THIS NEW RANGE THAT "GETS MEALS" ALL BY ITSELF
Can you imagine anything more desirable than to be able to walk out of your kitchen in the early morning and return at night to find a deliciously cooked dinner waiting to be served?
That's the new freedom you will enjoy with a Westinghouse Electric Range. While you're away, the Westinghouse "Flavor Zone" oven does everything you would do. It automatically turns on the heat when cooking should start. It browns to perfection, turns off the current at the right moment, and finishes cooking by retained heat. ONLY $4.95 DOWN
MOUNTAIN STATES POWER COMPANY

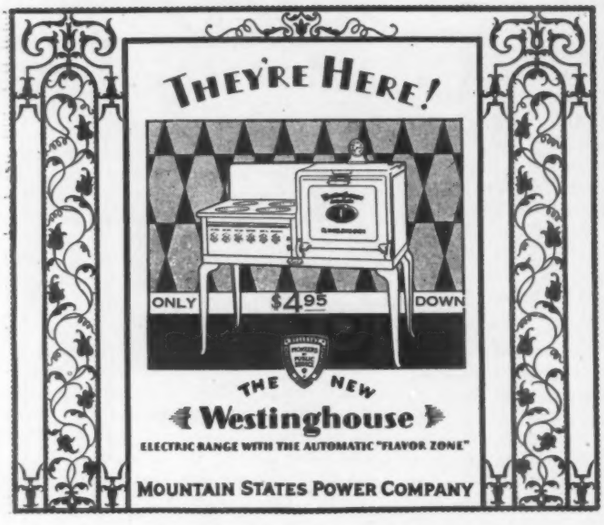
10 MINUTES IN THE KITCHEN
. . . AND YOU CAN SERVE A COMPLETE OVEN DINNER
That's all the time you need to take the food from the refrigerator, place it in the cold oven, and make the two simple adjustments necessary for "Flavor Zone" cooking.
all the time it takes for you to get a delicious, oven dinner this most modern way!
and oven control have been especially designed "Flavor Zone" cooking completely automatic. no watching or tending. You don't have to Westinghouse Electric Range from the time food in the oven until it is ready to serve.
be visiting, marketing, or at a club meeting "Flavor Zone" oven automatically turns on the nd starts cooking. When the best browning ure has been reached, the current is shut off ally and cooking is finished by retained heat. r have to give your dinner a single thought.
OUNTAIN STATES OWER COMPANY
SURE YOU'RE TIRED SO IS YOUR WIFE BUY THAT RANGE


don't be
satisfied with the commonplace!
You never saw the equal of these new electric ranges. Except for setting the clock and the thermometer when you put the food in the oven (cold), you don't have to watch or touch a thing until cooking is completed.
No initial searing is required. No hand adjustments are necessary. No basting to do. No water to add. For "Flavor Zone" cooking
start to finish and there
Westi
THE ELECTRIC RANGE WITH TH
ONLY $
MOUNTAIN STATES

A Modernistic Range Campaign

THE attention arousing qualities of "l'art moderne" were used to good effect in the advertising campaign in connection with a recent range sale conducted by this company in northern Oregon. Dealer-help material of the manufacturer and local copy were combined by J. H. N. Adams, in charge of the company's advertising. Various sizes of copy are shown reproduced here.

Westinghouse
THE ELECTRIC RANGE WITH THE AUTOMATIC "FLAVOR ZONE" OVEN
OLD TIME GOODNESS
PLUS THE NEWEST COOKING CONVENIENCE
Richly flavored meats, succulent vegetables, puddings that melt in your mouth, are just as typical of the modern "Flavor Zone" cooking as they were of the old Dutch oven. For the "Flavor Zone" oven first browns the food to perfection, then cooks it to wonderful tenderness. And it does both of these automatically without any watching or tending on your part.
In the morning, or when you are clearing up after lunch—you can put your entire dinner in this oven. Make two simple adjustments, close the oven door, and you can stay out of the kitchen all afternoon if you want to.
At the proper moment, the current comes on automatically and browns the food. Then it is automatically turned off and cooking continues on stored heat until everything is done to a turn.
ONLY $4.95 DOWN
MOUNTAIN STATES POWER COMPANY



Retail Selling—*What Lies Ahead?*

By E. J. Clary.

As author of "The New Retailing" and merchandising consultant, this writer has had an opportunity to study the trends in retail buying and selling in all lines. What he has to say is applicable to electrical merchants equally as much as to any other merchants.

IN THE past few years retailing has assumed the distinctive status of an industry by itself. This is because the general interests of merchants in all lines are more and more similar. The trade associations of the country, local and national, have served to bring this condition about.

In the present day, retailers are prosperous or otherwise on the basis of regional conditions rather than on the basis of the particular line in which they may be engaged.

This being the case at the present time we can define the problems that face retailers in general, regardless of their line of business, and apply those ideas and remedies that come from general experience in the buying and selling of goods to the public. It is only in very recent years that the merchant has learned to profit by experience—to utilize hard won experience in future operations. This is due to:

(*a*) The closer unity among retail merchants in general, and
(*b*) The activities of the trade associations of the country in fostering a spirit of co-operation.

Putting Experience to Work

Experience in sound retailing is piling up. Tens of thousands of merchants who, years ago, went their own way, made their own errors (and paid for them!) are using it to a greater extent every year. This is proved to a great degree by the increasing amount of merchandising information being prepared and circulated by the United State Department of Commerce, leading universities and progressive trade magazines in all fields.

Now that retailing is on a scientific basis, what lies just ahead?

Reference is here made to that period extending from the winter of 1928 to the winter of 1929. Grant that each line of business offers special problems, the results of particular conditions in that business. Yet there is a whole crop of problems which are general and which are common to every store in whatever line and at whatever place.

More and more attention must be paid to these general problems due, perhaps, to the vast development of chain store operation and the changing ideas in modern management which it has brought about. Those close to retailing throughout the United States are able, quickly, to spot these outstanding general problems and to discover the remedies which are being used to solve them most effectually.

As I see it, the outstanding points in successful retailing the coming eighteen months or two years may be summed up briefly:

1. Financial problems;
2. Buying problems;
3. Inventory problems;
4. Selling problems.

Financial Survival in Conservation

In approaching the financial side of the retail business, the successful merchant in the next year or two will practice a system of conservation—conserving capital and sustaining credit by every means possible consistent with a fair rate of expansion. In the main, retailers are financially sound to an unusual degree in most regions; but the tendency to strain credit and capital is here and there evidenced in a striking manner. In such cases, resources are being impaired seriously.

It will be necessary, more than ever, in the next two years for the retailer to watch his financial affairs, to establish and maintain an even balance in money matters. Some form of control is a vital matter.

Buying Normally

When it comes to buying problems we find an even more important factor.

I find that the outstanding feature of present-day buying is lopsided stocks. The influx of sidelines in all retail trades has resulted in:

(*a*) A sometimes perilous reduction of inventories in staple and standard goods and lines.
(*b*) The effects of inexperience in buying and selling sidelines, and
(*c*) Unbalanced inventories with the resultant dead ends, markdown losses.

We find that the hand-to-mouth buying practice which followed in the wake of the war has gradually been superseded by ordering along more nearly normal lines. This is clearly reflected in the reports of jobbers and manufacturers in at least sixteen lines of business.

It is true that conditions in retailing five to eight years ago perhaps warranted hand-to-mouth buying; but the situation at present and in the next year to come will require more careful though more liberal orders on jobbers.

After all, a retail business must sustain its staples if it is to establish and build for permanency. The staple-buying public is the public that sustains any retail business no matter what its line may be. The merchant who sacrifices unduly his staple stocks to sidelines and specialties will feel the evil effects of it ever more keenly in 1929.

All merchants compete for the home market.

The foundation for all buying, to meet conditions of today and the near future, should be laid upon these principles:

(*a*) Check on current inventory.
(*b*) Turnover rate, established by a progressive inventory record.
(*c*) Rate of gross sales increase for 1928-27.
(*d*) Study of local public requirements and potential.

Watch the Inventory

More and more retailers are learning the vital importance of inventory control and the establishment of a simple system that will prevent over-buying as well as under-buying.

It is not safe now and probably will not be safe in the next two years for the retailer to buy on "hunches" or by guesswork. It no longer is profitable to carry the inventory in the head. It must be on paper, easily accessible and subject to regular check.

The oft-repeated phrase, "We carry complete stocks," often is taken to mean that the store buys everything the market offers—ties up its capital—but what should be meant is that the store carries everything in demand by its own local market. Every retailer will do well to keep his inventory keyed up precisely to his own trade, his own field of operations. In so doing, he is meeting fully the "complete stocks" slogan.

The inventory of any store should truly reflect the wants and needs of the local trade. Where it fails to do so there can be only one result—the retailer does an overheavy percentage of his business on a small percentage of his stocks and his profit is reduced or wiped out through depreciation and markdown.

That is why it is claimed that inventory control is becoming more and more essential in retail merchandising.

That this control is becoming more and more the rule throughout the country is a fact and proves its importance in more ways than one.

From coast to coast, in a dozen lines of retail business, I have witnessed the results of a careful system of inventory control, and in many instances dealers have admitted freely that for years they could not see the value of such control.

(Next month Mr. Clary will devote an entire article to 1929 selling problems.)

News of the Industry

Western Issues in Recent Election

Results on Questions of Importance to Electrical Industry Show Trend in Various Sections

RESULTS of the election on certain issues in various sections of the Far West are of special interest to members of the electrical industry because of the bearing of those issues upon that industry.

Oregon Refuses to Close Rivers

By a margin in each case of about two to one the four river-closing measures appearing on the ballot in Oregon by initiative petition were defeated. These bills, each restricting appropriation of water from a different river, received about the same number of votes for and against, indicating that the voters treated the measures pretty much as a unit involving a single principle. The two-to-one defeat came about largely through large margins against the bills returned from some of the counties, which tended to increase the comparatively narrow margin of defeat returned by Multnomah County in which Portland is situated.

The measures were designed to protect game fishing on the Rogue, Umpqua, Mackenzine and Deschutes Rivers and would have prohibited any further appropriation of water from these streams and their tributaries for commercial or municipal purposes or for irrigation. The power interests formed the chief point of attack in the campaign conducted by the sponsors. The measures met opposition at the hands of a league organized largely by the chambers of commerce throughout the state, which took the position that passage of the bills would stifle the state's industrial development.

The largest vote was that on the Rogue River Bill, which stood 77,274 for and 150,937 against, or a ratio of about 1.95 to 1. A slightly smaller vote was cast on each of the other three bills, but with the ratio in each instance greater than 2 to 1.

Arizona Has New Governor

G. W. P. Hunt, Democratic governor of Arizona since 1912, ardent champion of Arizona's rights on the Colorado River and bitter opponent of the proposed Boulder Dam project, was defeated by John C. Phillips, Republican. However, Mulford Winsor, secretary of the Arizona Colorado River Commission, in a written statement has declared: "The recent election did not alter the situation in any particular. There appears to be no difference between the views of Governor-elect Phillips and the principles which have guided the River Commission. It is expected that there will be complete harmony and accord and that Arizona will continue to present a united opposition to all proposals to despoil her. . . . ."

Senator Ashurst (Democrat), also a determined supporter of Arizona's stand, was re-elected, as were Governor Dern and Senator King of Utah, both opponents of the Swing-Johnson Bill.

California Modifies Riparian Rights Law

In California a constitutional amendment was adopted modifying the original principle of riparian rights by stipulation that these rights shall extend only to beneficial use of the waters of California streams. The old English common law of riparian rights, established in 1850, granted every property owner a vested right to the natural flow of water in any stream that adjoined or passed through his property. That law has been the subject of much litigation and was the underlying cause of the famous Herminghaus suit against the Southern California Edison Company to enjoin it from storing water for power generation in mountain areas. It was the hope of those who have studied the California water law that the amendment would do much to straighten out a complicated situation which in the past has hindered use of water for irrigation and power. However, since the amendment was passed, a superior court judge, trying a suit brought against the Merced Irrigation District by a land owner who sued for damages for the loss of riparian rights on his land, has rendered a decision in favor of the plaintiff on the grounds that "the state cannot authorize the riparian rights of any individual to be taken from him without compensating that individual for his loss." The opinion is believed tantamount to a declaration that the amendment is unconstitutional.

San Francisco Defeats Utility Measures

In San Francisco three proposed charter amendments dealing with public utilities were defeated.

Amendment No. 22 would have created a public utilities commission of three, to be appointed by the mayor and to have jurisdiction over all publicly owned and operated utilities. The vote stood: No—74,092; Yes—47,838. San Francisco now owns the 100,000-hp. Moccasin plant, a part of its Hetch Hetchy development, with a transmission line but no distribution system, and contemplates acquiring one or both of the present privately owned distribution systems in the city. It also operates a street railway system in competition with the Market Street Railway Company, and recently voted bonds for the purchase of the Spring Valley Water Company's system.

Amendment No. 23 would have made it possible to finance the acquisition or extension of public utilities by the city through the issuance of bonds authorized by a majority vote and payable, both as to principal and interest, out of revenue only. The measure was defeated by a vote of 95,348 to 34,852. At present the charter requires a two-thirds vote on bond issues and limits bonded indebtedness of the city to 12 per cent of the real and personal property in the city.

By a vote of 93,849 to 67,771 amendment No. 24 was defeated. Under this amendment the Market Street Railway Company would have surrendered its expiring franchises and received in return revocable permits containing all the provisions of the original franchises, including the 5-cent fare.

California Communities Want Boulder Dam

By large majorities the voters of Los Angeles and ten other neighboring southern California municipalities approved the organization of a metropolitan water district to bring a domestic supply of water to that territory after the Boulder Canyon Dam has been constructed. In the opinion of Clayton R. Taylor, chairman of the board of city directors of Pasadena, this large affirmative vote "constitutes a direct and telling message to the United State Senate, which we trust will result in favorable action by that body during the ensuing session of Congress when the Swing-Johnson Bill on the Boulder Dam will come up for action."

San Joaquin Co. Builds New 70-Kv. Substation

Increasing installation of deep-well pumps in the grain lands of the Tulare lake bottom is responsible for a $75,000 construction project of the San Joaquin Light & Power Corporation which will add another 70-kv. substation and a 15-mile, 60-kv. transmission line to the power facilities of the valley region.

The new Midlake substation, which is expected to be completed about Dec. 15, is equipped with four 1,250-kva. transformers and is automatic in operation. It is situated on the north end of the lake bottom, about half way between Corcoran and Lakeside substations, which are now serving the heavy load of that territory.

B. C. Company President to Head Holding Company

George Kidd, president of the British Columbia Electric Railway Company, has resigned that office and accepted the chairmanship of the board of directors of the British Columbia Power Corporation, the holding company, to take effect Jan. 1, 1929. W. G. Murrin, vice-president, will take over the office of chief executive.

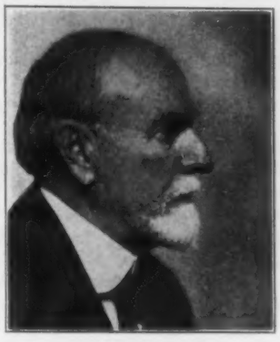
Mr. Kidd thus completes a period of fifteen years as head of the British Columbia utility company. He was educated as a chartered accountant and was appointed secretary of the British Columbia Electric Railway Company in 1907, with headquarters in London. Four years later he went to British Columbia and acted as comptroller until May, 1914, when he was appointed general manager. The office of general manager was changed to that of president in August, 1923.

Mr. Murrin began his public utility career with the City of London Electric Lighting Company in 1903. Later he became works manager and electrical engineer of the London United Tramways Company, which he left in 1913, going to British Columbia as mechanical superintendent of the B. C. Electric Railway Company. From general superintendent he became assistant general manager in November, 1916, and was appointed vice-president in August, 1923.

Changes in McGraw-Hill Official Personnel

Company to Have Chicago Building

RECENT growth and expansion of the McGraw-Hill Publishing Company have led to action by the board of directors separating the offices of chairman of the board and president of the company, both of which have hitherto been held by James H. McGraw. Under the new plan of organization Mr. McGraw will continue as chairman of the board. Malcolm Muir, formerly vice-president, has been elected president of the company and chairman of its executive committee. He has been with the organization for the past 23 years and has been identified with many phases of its activities. James H. McGraw, Jr., vice-president and treasurer, has been elected vice-chairman of the board, and chairman of the company's newly created publishing committee.



JAMES H. McGRAW

MALCOLM MUIR

Through merger and purchase in recent months, the McGraw-Hill Publishing Company now comprises nine subsidiary and associated companies publishing business and industrial magazines, engineering books, catalogs and directories. Twenty-four magazines serving ten fundamental industries and covering business broadly are published at such widely distant points as New York City, Chicago, San Francisco and London. The direct effect of this coordination of related publishing interests will be to enhance publishing facilities for the group as a whole beyond those which any single paper or lesser group might enjoy. At the same time, as the official announcement of the board of directors points out, these developments have greatly multiplied executive responsibilities and have necessitated a readjustment of the administrative duties of the company's principal officers.

Further signalizing the rapid development of its publishing operations, the McGraw-Hill company is having erected for it in Chicago a building to bear its name and for the first time is placing there a resident vice-president as head of its Chicago interests. The building is now in course of erection at 520 North Michigan Ave., two blocks north of the Wrigley Building, in a rapidly developing new business center, and will house all the McGraw-Hill interests centering in Chicago. The resident vice-president will be Edward J. Mehren, formerly vice-president and editorial director in charge of editorial work of all the company's publications, who has been with the McGraw-Hill organization in New York for 22 years in editorial and publishing capacities.

For 25 years the company has maintained in Chicago large editorial, sales and circulation staffs, in intimate contact with those who have been making engineering and industrial history in that territory. To be more intimately a part of the great engineering and industrial development of the Middle West, present and forthcoming, the company had long planned to publish part of its group of papers there, and having accomplished that purpose, now signalizes its establishment of a publishing center in Chicago by taking its own building and installing there a resident vice-president.

Artist's drawing of McGraw-Hill Building to be erected in Chicago.

First Unit of 300,000-Hp. Steam Plant Begun

Initial work on the first unit of the steam power plant which the Puget Sound Power & Light Company will build on Lake Washington at Renton has been started, and company officials have announced that construction of a second unit will be started immediately upon completion next September of the unit now being built.

The plan to erect a steam plant which marks a departure of the company from the utilization of hydroelectric power, has been adopted for reasons of economy. The first Renton unit is expected to develop 50,000 hp. at a cost of from $100 to $110 per horsepower. The steam development program calls for six units with an ultimate capacity of 300,000 hp. at a total cost of $30,000,000 to be constructed as fast as the demand for power justifies. At the present rate, it is declared, the growth will demand a unit a year until the project is completed.

Contrary to first report, which stated the station would be known as Lakeside, the name of the new plant is to be Shuffleton Steam Station in honor of S. L. Shuffleton, vice-president of Stone & Webster, Inc. W. D. Shannon is superintendent of construction.

Power Projects of Western Canada Bring Problems

British Columbia Correspondence.

In the greatest program of electrical development in the history of Western Canada projects are already under way or about to start that will add nearly 50 per cent to the total electrical output of the province in the next two years, according to plans filed with the government here.

Altogether 218,500 hp. will be added to the electrical supply of the province, now 480,000 hp., by current power projects, the plans now on record show. This is made up of three large developments and a series of smaller projects.

The great Bridge River plant of the B. C. Power Corporation will produce 60,000 hp. as soon as it is opened, but this, of course, is only a fraction of the power that will flow from the power site there when it is fully exploited up to 300,000 hp.

At South Slocan the West Kootenay Power & Light Company is about to throw in the switch on a development of 60,000 hp. in addition to all its other production. On the Pend Oreille River the same company is ready to go ahead with a plant which will turn out 80,000 hp. at a cost of probably $4,000,000.

Further east, on the Elko River, the East Kootenay Power Company is planning to proceed immediately with the construction of a plant to turn out 15,000 hp. to supply consumers as far east as the Alberta side of the Crow's Nest Pass.

In addition to these major developments, the B. C. Electric Railway Company is adding 2,000 hp. to its Jordan River plant, outside Victoria, while 1,500 hp. will be developed by the West Canadian Hydro-Electric Corporation at its new plant on the Shuswap River, for consumption in the upper Okanogan Valley and surrounding districts.

While private interests thus are busy harnessing the province's waterpower on an unprecedented scale, the problem of controlling these operations and protecting the consumers of electricity is becoming increasingly evident. Probably it will form one of the main themes of discussion when the legislature meets early next year.

Definite demand will be made at that session for the creation of a public utilities commission without further delay. The Union of B. C. Municipalities is sponsoring this proposal, but, as a matter of fact, the need of some machinery of this kind has been realized at the capitol for some years. Only the fact that an election was pending and a large mass of miscellaneous business requiring attention prevented the public utility commission issue from forcing action by the House at its last session. Since then the demand for a commission has reached such proportions that it cannot longer be left unanswered, in the general opinion of those at the capitol.

Since the House met last three important developments have focused public attention on this question. First and most important, the sale of the B. C. Electric Railway Company, with an enormous increase in its capitalization; second, the dispute between the West Kootenay Power Company and some of its chief consumers; and third, the clash between the Victoria city authorities and the B. C. Electric Railway over power rates, with the city threatening to develop its own power if it cannot get satisfaction from the power company.

In addition to all these difficulties, the complicated condition of power charters in the new amalgamation of Greater Vancouver appears to officials here to demand some new form of centralized control to put the city's future power rates on a satisfactory basis.

Distinguished Service Medal Awarded R. H. Ballard

The John B. Miller medal for distinguished service was presented to R. H. Ballard, president of the Southern California Edison Company, at a testimonial dinner held recently at the Hotel Huntington, Pasadena, Calif. More than 100 guests, including directors, officials, department heads and district managers gathered in the banquet hall to do honor to Mr. Ballard. Following the dinner Mr. Miller, chairman, presided over an informal program which was climaxed by the presentation of the medal. Mr. Ballard is the first to receive the John B. Miller medal.

Thirty-one years ago R. H. Ballard joined the Westside Lighting Company, an organization to which the present Southern California Edison Company traces its source. As California grew, the Southern California Edison Company grew and Mr. Ballard by intensive study and application kept pace with this growth.

In 1920 he was made general manager and in 1924 was honored by being made executive vice-president and general manager. In March of this year he was made president of the company. He has participated in many of the important negotiations which contributed to the successful expansion of the company.

Byllesby Company Forms Mexican Utility Company

Organization of Empresa de Servicios Publicos de los Estados Mexicanos, S. A. (Mexican States Public Service Company, Inc.) for the acquisition of utility and industrial properties in Mexico, has been announced by John J. O'Brien, president of H. M. Byllesby & Company, Chicago.

The transaction includes the purchase by the newly organized operating company of an electric plant at Hermosillo, Sonora; purchase of the electric plant, ice plant and miscellaneous industries at Guaymas, Sonora; and the purchase of the electric plant at Culiacan, Sinaloa, Mexico.

It has been provided that the Mexican States Public Service Company, Inc., immediately will make substantial enlargements and line extensions of the electric plants at Hermosillo and at Guaymas.

Los Angeles Now Operating Plant Wrecked by Disaster

Following seven months' continuous work, the Los Angeles Bureau of Power and Light on Nov. 2 placed back in complete operation San Francisquito power plant No. 2, which was destroyed by the St. Francis dam disaster last March.

Bureau engineers broke several construction speed records. The San Francisquito power plant No. 2 with a generating capacity of 44,000 hp. was virtually obliterated on the night of March 13 by the raging wall of water which rushed down San Francisquito Canyon following the destruction of the dam. Twenty-four hours later engineers and laborers were set to work clearing away the debris and preparing to reconstruct the second largest generating unit on the municipal Power Bureau's system.

The losses suffered by the Power Bureau in damage to power plant No. 2, including that of the hydro-electric energy which went to waste during the time the plant was out of commission, are estimated at $2,000,000.

Reverse and obverse of the John B. Miller Award for Distinguished Service presented to R. H. Ballard.

Socopo Preaches Doctrine of Electrification

IN A recent Parade of Progress in Pueblo, the float entered by the Southern Colorado Power Company showed the freedom from kitchen worries brought about through the use of modern electrical conveniences in the home. The front part of the float represented a veranda on which, very appropriately, the company's Ukelele Girls played their instruments, thus typifying the leisure resulting from the use of electricity. The rear was fitted up as a complete electric kitchen, properly lighted, with automatic electric range, water heater, refrigerator and other electrical appliances.

The view at the right shows the booth entered by the company at the local state fair. The huge electric sign bore the company's name in red, white and blue lights and the center of the sign was filled with yellow, orange and red chrysanthemums. Above the name was placed an illuminated Byllesby shield. Refrigerators, water heaters, ranges, washers, ironers and cleaners were arranged about the booth and in the center appeared a display of electrical table appliances of the latest design.

Boulder Dam Estimates Too Low, Engineers Report

Although the report of the investigation of the proposed Boulder Dam project made by the commission of engineers appointed by the Secretary of the Interior had not been released at the time this was written, press dispatches from Washington state that the summary in the hands of President Coolidge declares that the previous estimates of the cost of the project submitted by officials of the Reclamation Service are too low. These estimates are based on a total cost of the project of $125,000,000. The commission estimates the cost at $165,000,000.

"Either the Boulder or Black Canyon site is suitable for the proposed dam," the report reads, but preference is expressed for the Black Canyon site, and the estimates made by the engineers are based on construction at that site. The additional $40,000,000 covers suggested changes in the engineering plans in the interest of greater safety and changes in the proposed methods of construction. In the construction of the dam these include the use of caissons in the deeper portions of the river bed and the building of two diversion tunnels, and the lining of the All-American Canal where it passes through blow sand. With the modifications suggested, the board is of the opinion that it is feasible from an engineering standpoint to construct a dam, according to the summary.

The Boulder Dam Bill, passed by the House and pending in the Senate, provides that the Secretary of the Interior "shall make provision for revenues, by contract, in accordance with the provisions of this act, adequate, in his judgment, to insure payment of all expenses of operation and maintenance of said works incurred by the United States and the repayment, within 50 years from the date of the completion of the project, of all amounts advanced, together with interest thereon."

In the opinion of the commission, the government's investment, estimated at $165,000,000, cannot be amortized in 50 years unless changes in the present general plan are made. The changes recommended are: Elimination of the cost of the All-American Canal from the amount reimbursable from power and water revenues; elimination of a reasonable charge for the flood control features of the project from the amount reimbursable from power and water revenues; provision for additional revenues from the water which is to be stored in the reservoir and which will be available for sale for domestic and irrigation purposes.

A continuous output of 550,000 hp., or 1,000,000 hp. on a 55 per cent load factor, would be obtained from the power plant, the engineers estimate. A rapid development of irrigation is to be expected if the project is adopted by Congress, it is pointed out, and this will reduce the power output over long dry periods.

The Colorado River Compact introduces an additional element of uncertainty in the stream flow of Boulder Dam, the report states, as the compact permits the withholding by the upper valley states of "more than their equitable share, provided 75,000,000 sec.ft. of water is let down in each ten years of the period."

West Kootenay Co. Plans to Build 80,000-Hp. Plant

Permission to apply for a license to build a large hydro-electric plant on the Pend Oreille River, a few miles below Box Canyon and on the Canadian side of the river, has been granted the West Kootenay Power & Light Company, according to announcement of F. P. Burden, minister of lands for British Columbia.

The proposed site of the West Kootenay plant is only a few miles from the site which Hugh L. Cooper proposes to develop. Surveys for the West Kootenay plant are now being made, it is understood. Plans contemplate an 80-ft. dam at the junction of the Pend Oreille and Salmon Rivers, and a power plant with an estimated capacity of 80,000 hp. Such a dam would not raise the water sufficiently to backflow into United States territory, thus obviating any international disputes.

Apply for License on Power Project in Colorado—Having complied with the terms of their preliminary permits, Jones Brothers, of Pueblo, Colo., have applied to the Federal Power Commission for a license covering their project on North and Middle St. Vrain and Cabin Creek, near Denver. It is proposed to construct three reservoirs, one with a capacity of 5,000 acre-ft., another with 3,968 acre-ft., and a third with 1,485 acre-ft. In this way 8,230 hp. of primary power will be developed. It is proposed, however, to install 15,000 kva. at one power house and 12,000 kva. at another. The power is to be used for public utility purposes.

Feasibility of Deadwood Reservoir Approved

President Coolidge has approved the feasibility of the Deadwood Reservoir in Idaho, on the recommendation of the Secretary of the Interior. Congress authorized this construction at its last session, but, under the reclamation law, before the work could proceed it was necessary for the Secretary of the Interior and the President to make a determination as to feasibilty.

The Deadwood dam, which will have a capacity of 160,000 acre-ft., will be located on the Deadwood River, a tributary of the Payette, 60 miles northeast of Boise, Idaho. It will be of arch design, 600 ft. long and 160 ft. in maximum height.

A diversion dam and power plant already have been constructed on this project at a cost of $1,949,000, but to utilize this structure properly and attain the maximum return from the investment already made it becomes necessary to provide additional storage by the construction of this reservoir at a cost of $1,200,000, of which $800,000 was appropriated at the last session of Congress.

It is estimated that the receipts from the sale of the power generated under the project will be ample to return the entire cost of construction of the reservoir within 40 years.

Insull Medal Is Awarded to San Diego Co. Lineman

The coveted Insull Medal awarded by the National Electric Light Association for the saving of a life by the Schaefer prone-pressure method of resuscitation is in the possession of F. L. Carter, a lineman employed by the San Diego Consolidated Gas & Electric Company. Presentation was made

F. L. CARTER

by W. F. Raber, vice-president and general manager of the company, before a recent meeting of employees. The ceremony was a feature of a special educational program conducted by the San Diego company's electric distribution department.

Mr. Carter saved the life of William Howard Brown, a school boy residing at Oceanside, Calif., on Feb. 9, 1928. Young Brown came in contact with a 2,300-volt line which, during a heavy wind storm, had fallen in the rear of his home. A line crew searching for the fallen wire arrived at the same instant that the accident occurred. Mr. Carter rushed to the boy, cut the wire and brought the unconscious youth back to full consciousness by artificial resuscitation.

Progress Report on Power Company Sales Plans Made at Industry Meeting

SOMEWHAT in the nature of a progress report on the co-operative sales plans of the two power companies serving northern California, namely, the Great Western Power Company and the Pacific Gas and Electric Company, was a meeting held Oct. 25 at the Clift Hotel, San Francisco, to which the entire industry was invited. It was a follow-up of a similar meeting held last March at which the Electragists outlined to the other branches of the industry their program of constructive work and urged the support of the movement and the assistance of all branches of the industry in bringing more members into the Electragist organization. (See Electrical West, April, 1928, p. 233.)

The luncheon meeting at the Clift Hotel was featured by several items of considerable import. The first was the announcement that the Red Seal campaign for the year had exceeded its quota in eight months. The second was an invitation from the executives of both power companies to independent dealers to discuss with the power companies their forthcoming sales campaigns before the policies are announced. The third significant feature was the announcement by R. A. Sharon, assistant to the vice-president and general manager, Great Western Power Company, that "company salesmen are paid commissions on all sales in their territory whether the sale is made by the company or through the dealer."

The meeting was opened by C. T. Hutchinson, chairman, California Electrical Bureau, who described the purpose of the meeting as an accounting for the work of the past year. As a result of the work of the Red Seal campaign in building domestic load, he said, 723 homes had been wired according to the Red Seal plan in 1926, 895 in 1927, and the quota of 1,123 for 1928 had been exceeded in the first eight months. The effect of Red Seal campaign work has been to double the number of light outlets, add 50 per cent to the number of switch outlets and double the number of convenience outlets. Of these Red Seal homes, those wired for air heaters have been increased from zero to 49 per cent and for water heaters from zero to 43.3 per cent. More than 80 per cent of the occupants of Red Seal homes cook electrically, raising the monthly revenue to central stations from $3.20 to $11.21 average for Red Seal homes.

R. E. Fisher, vice-president in charge of public relations and sales, Pacific Gas and Electric Company, was next introduced. He reviewed the merchandising principles adopted by the N.E.L.A. and allied groups (see Electrical West, May, 1928, p. 284) and reiterated the Pacific Gas and Electric Company's stand in merchandising. (See Electrical West, April, 1928, p. 234.)

Mr. Fisher announced that term payments, according to recommendations of the N.E.L.A., would be cut to 18 months maximum. He then reviewed the company's activity in the past nine months in which $1,000,000 worth of appliances have been sold by the power company. During that time other dealers have sold $1,000,000 in appliances, and the wiring has amounted to $750,000.

In announcing the company's intentions for its 1929 sales plan he said that policies would remain about the same. "Similar classification, similar stress, similar man-power will be used; only minor changes will be made," said Mr. Fisher.

He also said that he welcomed discussion by dealer groups, inviting them to come in and show where the sales policies could be changed to the better advantage of all concerned.

Mr. Fisher closed his talk with a strong appeal to his salesmen and sales managers to support the reputable Electragist contractors in their communities rather than to turn over to fly-by-night contractors the wiring business necessary.

Mr. Sharon, representing the Great Western Power Company, was next introduced. He began by reading again the instructions to all sales departments regarding the servicing of electric ranges and water and air heaters connected to the lines of his company, whether sold by the company or by a dealer. He announced the policy of the company as that of merchandising only those appliances not yet having received complete public acceptance and therefore requiring educational sales effort. Electric ranges, water heaters and air heaters are the only appliances in the latter class.

"It is not reasonable to expect that the contractor-dealer can afford to devote the time or effort, or shoulder the expense necessary to secure a satisfactory volume of these appliances. By way of illustration, the company has been engaged in the sale of ranges and water heaters since 1914, and on the first of January, 1929, fifteen years after the first ranges were sold, it is expected that there will be on the company's lines approximately 6,500 ranges, 2,500 water heaters, and 4,500 air heaters. The fact that it has taken that length of time to place that small number of appliances in the hands of its consumers, and the fact that this

was done only at a great cost to the company, is a clear proof that only by such continued effort can the company expect any measurable results," declared Mr. Sharon.

It was then that he announced the sales policy with regard to paying salesmen commissions on sales whether made by the company or through a contractor-dealer. Manufacturers' list prices are maintained on all individual sales, he declared, and quantity discounts are given only to those classes of business that in general receive similar discounts from other competitive lines.

He also pointed out that of all appliances sold during 1928, 36 per cent of the ranges, 32 per cent of the water heaters, and 71 per cent of the air heaters were sold through other channels than the company.

Mr. Sharon ended his talk by welcoming "at all times constructive criticism of our sales policies. The company stands squarely for fair treatment of all the various branches of the industry."

Clyde Chamblin, president of the Association of Electragists, International, though called upon without warning, re-emphasized the necessity of supporting the reputable Electragist in the community. He pointed out how it is to the interest of all branches of the industry that the man who is firmly established, who knows his costs, and is a constructive influence in the betterment of the industry and the support of the industry's sales programs, is a better man to give business to than the inexperienced, ignorant wireman who operates on a shoestring and who may not be in business, should trouble later occur on the installation which he has made.

FINANCIAL NEWS

Commission Cannot Pass On Foreign Stock Issues

In a recent decision the California Supreme Court upheld the contention of the California Railroad Commission that it has no jurisdiction over the stock sales of a public utility organized in another state before the passage of the existing Public Utilities Act, even though that utility may be doing business in California.

The opinion was rendered in a suit brought by The Southern Sierras Power Company, Riverside, which had applied to the California Supreme Court for a writ of mandate to compel the Railroad Commission to exercise jurisdiction to hear and determine the company's application for permission to issue $2,000,000 of preferred stock for refunding of outstanding indebtedness. On the company's first application the Railroad Commission had declined to grant the necessary authority on the ground that the company was a Wyoming corporation and therefore the Railroad Commission had no jurisdiction in the matter. The power company asked for a re-hearing, which was refused, and it then applied for the writ of mandate, which the court denied, thus upholding the Railroad Commission's contention.

In Ten Months Edison Stock Sold to 30,096 Persons

Evidencing the confidence which they feel in the future of the Southern California Edison Company, 30,096 individuals during the first ten months of this year have purchased Edison stock with a par value of more than $25,182,000, according to a statement coming from the office of R. H. Ballard, president. This figure includes both cash and installment sales. Cash received from stock sales during this time amounted to $21,319,252, the balance of the stock having been sold on the installment basis.

The figure of 30,096 net individual subscriptions for this ten-month period includes both new and old stockholders. The average amount (par value) of stock purchased per subscriber during 1928 has been $850. It is interesting to note that of the total number of subscribers secured this year to date, approximately 50 per cent were women.

On Nov. 1 the company had a total of 118,146 stockholders, owning stock with a par value of $168,781,522. The average holding per stockholder today is $1,425. This also is computed at par value of the stock.

Within the ranks of permanent Edison employees more than 5,000 or practically 98 per cent are stockholders and own outright or are paying for under contract $14,735,850 par value of Edison preferred and common stocks. Indicating that the Edison company is primarily a home-owned industry, the records show that 90 per cent of all of its 118,000 stockholders live in southern and central California and that practically all of them are consumers.

Hetch Hetchy Plant Profit for Year $1,005,014

The City of San Francisco's Hetch Hetchy power plant made a profit of $1,005,014 for the fiscal year ended June 30, 1928, according to a report filed recently with the Board of Supervisors by certified public accountants. The report includes comparison revenue credits for power used for city construction work and state and federal taxes. These credits are included in the report under provisions of the city and state charters which require that a publicly owned plant must set up charges which a privately owned plant must make, in order that comparative expenditures may be analyzed. Interest charges on the bonded long term debt are taken into consideration in the report, but no attempt has been made to take care of bond redemption charges, John P. Hannan, superintendent of accounts of the Board of Public Works stated. The profit of the plant since its dedication August 16, 1925, is shown to be $2,707,014.54 up to June 30 of this year.

The fact that the Hetch Hetchy power plant is paying such revenue to the City of San Francisco is largely attributed to the agency contract with the Pacific Gas and Electric Company, by which power is distributed to consumers.

Unfavorable Report on Plan of Irrigation District

Unless the Imperial Irrigation District in the Imperial Valley of California is able to divert more than 74 per cent of the valley's power load from The Southern Sierras Power Company, which is now taking care of the district's electric needs, the plan to spend $2,100,000 for the development of hydro-electric power in the canal system of the district will not be a paying investment, according to the opinion of A. Kempkey, consulting engineer of San Francisco. Mr. Kempkey's report on the feasibility of the Imperial power proposal was made at the request of State Engineer Hyatt, and was made public by C. W. Brockman, director of the Imperial Irrigation District.

Mr. Kempkey estimated the cost of the five proposed hydro power plants and one steam unit would be $2,390,700, which is $290,700 higher than the estimate of the state engineer's office, and $690,700 in excess of the figures of M. J. Dowd, engineer for the Imperial Irrigation District, who recommended the project.

Although the state bond certification commission, after a year's delay, finally gave its approval early last month to the calling of a bond election (Electrical West, Nov. 1, 1928, p. 298), serious opposition has developed among valley property owners. This opposition is believed to have been responsible for the announcement recently made by the district directors that the district would postpone the date of the election until early next summer.

Washington Utility Buys Two Small Companies—Purchase by The Washington Water Power Company of the Ellis Electric Company, serving the towns of Rosalia, Fairfield and Waverly, Wash., and of the Malden Electric Company, serving Malden and Pine City, Wash., were effected this month. The addition of the new communities brings the total number served by the company to 105. The acquisition of these two distribution systems will add 625 customers to the system of The Washington Water Power Company.

Idaho Power Company Takes Over Utility of Murtaugh, Idaho—The Idaho Power Company has consummated a deal whereby it will take over the property and service of the Murtaugh Light & Power Company, a co-operative enterprise conducted for the distribution of electric service in the vicinity of Murtaugh, Idaho, for the past ten years. The Murtaugh company purchased its service from the Idaho Power Company, which will rehabilitate the system and provide pumping service for wells to be sunk for obtaining irrigation water.

Further Expansion of Claude Neon Electrical Products—With a franchise for the manufacture and distribution of Claude Neon lights in China, Straits Settlements and other Orienal countries, The Claude Neon Electrical Products Federal Corporation has been organized with a capitalization of $210,000 by Lloyd Gale, publisher of the Hankow (China) Herald, and Bruno Schwartz. The Claude Neon Electrical Products Corporation of California owns 20 per cent of the stock and will receive a royalty on all signs manufactured.

Pacific Coast Electrical Association

Correction of Error in Personnel Listing

Attention is directed to the fact that in the publication of the 1928-1929 personnel of the Pacific Coast Electrical Association in the Nov. 1 issue of Electrical West the heading for the electrical apparatus committee of the Engineering Section and the names of the chairman and vice-chairman through an error were omitted. This heading should have appeared on p. 301 following the personnel of the accident prevention committee and just above the heading, "Automatic Substations Subcommittee." The matter that was omitted is given in full below:

Electrical Apparatus Committee

H. T. Sutcliff, Pacific Gas and Electric Company, chairman.

H. L. Sampson, Southern California Edison Company, vice-chairman.

Engineering Section to Hold Conclave in Los Angeles—Jan. 16, 17 and 18, 1929, have been set as the dates for the next conclave of the Engineering Section, P.C.E.A. The meeting will be held in Los Angeles in the Los Angeles Gas and Electric Corporation Building.

Women's Committee Official

Mrs. Nyra G. Letchworth, of the San Joaquin Light & Power Corporation, has been appointed vice-chairman of the women's committee of the Public Relations Section, Pacific Coast Electrical Association. Mrs. Letchworth has been actively identified with women's committee work over a long period and has served as chairman of the women's committee of the San Joaquin and Midland Counties Public Service corporations for the past four years.

Northwest Electric Light & Power Association

Women's Committee Guest of Grays Harbor Co.

The women's committee of the Northwest Division, N.E.L.A., held its first meeting of this association year on Oct. 29 as guests of the Grays Harbor Railway & Light Company, Aberdeen, Wash., at the Pacific Beach Hotel.

The chairman, Mrs. Nell Laws, Puget Sound Power & Light Company, Seattle, outlined a program for the year as recommended by the National Women's Committee at its Chicago meeting in September. This program will stress "The Economics of Utilities," and the committees expect to continue to function as good-will builders and for the purpose of educating the women of the light and power industry in regard to the principles of the business.

All committees reported progress and it was brought out that a great deal had been accomplished in creating improved employee relationships, which it is felt will reflect in increasingly good service to the public.

The Grays Harbor company was a royal host, and no effort was spared to make the meeting successful. The local women's committee met with the visiting committee in an evening session and banquet on Monday at the Pacific Beach Hotel and later the evening was turned into one of Hallowe'en merriment, in charge of the Grays Harbor company's women's committee. The following day the visitors were taken for a drive to Lake Quinault.

Personnel for 1928-1929

EXECUTIVE COMMITTEE

R. M. Boykin, Puget Sound Pwr. & Lt. Co., president.
M. L. Hibbard, Idaho Pwr. Co., vice-president.
R. B. King, Idaho Pwr. Co., vice-president for Idaho.
W. B. McDonald, Mount. States Pwr. Co., vice-president for Montana.
G. L. Myers, Pacific Pwr. & Lt. Co., vice-president for Oregon.
P. M. Parry, Utah Pwr. & Lt. Co., vice-president for Utah.
N. W. Brockett, Puget Sound Pwr. & Lt. Co., vice-president for Washington.
W. W. Briggs, Grays Harbor Ry. & Lt. Co.
J. I. Colwell, Graybar Elect. Co.
A. E. Janssen, Idaho Pwr. Co.
L. A. Lewis, Wash. Water Pwr. Co.
J. P. Lottridge, East. Ore. Lt. & Pwr. Co.
A. C. McMicken, Portland Elect. Pwr. Co.
A. S. Moody, G. E. Co.
D. W. Proebstel, Portland Elect. Pwr. Co.
W. H. Ude, Wash. Water Pwr. Co.

OTHER OFFICERS

W. E. Best, Puget Sound Pwr. & Lt. Co., treasurer.
B. H. Snow, "Electrical West," secretary.

ACCOUNTING SECTION

EXECUTIVE COMMITTEE

A. E. Janssen, Idaho Pwr. Co., chairman.
M. J. Wilkinson, Pacific Pwr. & Lt. Co., vice-chairman.
F. W. Brownell.
(and the chairmen of the following committees)

CLASSIFICATION OF ACCOUNTS COMMITTEE

W. F. Miller, Wash. Water Pwr. Co., chairman.

CUSTOMERS' RECORDS COMMITTEE

B. H. Parkinson, Pacific Pwr. & Lt. Co., chairman.
N. B. Whittier, Portland Elect. Pwr. Co., vice-chairman.
F. J. Cooper, Idaho Pwr. Co.
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Contractors, Dealers and Inspectors

"Blue Shirt" Convention Confines Itself to Contractor-Dealer Problems

ALL frills eliminated, and the work of three days of meetings condensed into one busy morning and afternoon, the state convention of the California Electragists at Fresno, Oct. 27, resulted in more accomplishment for time and effort expended than probably any previous convention. Limited to contractors and motor dealers only, this "blue shirt" convention drew to it a larger number of contractors and dealers than any previous mixed or industry convention.

This fact alone, coupled with the accomplishment of the day, convinced the membership that each state convention in the future would be conducted along similar lines and that the industry at large would be invited only to its northern and southern divisional meetings.

Following the opening of the meeting by President H. H. Walker, of Los Angeles, Saturday morning, C. J. Guisbush, secretary-manager, plunged into a prepared outline of the day's activities. The first item under discussion was that of enlarging the membership of the association. Workers who would be a credit to the organization but not the drones who come in and drop out to the economic loss of the organization, were urged as the type of material to be sought. President Walker urged the placing of responsibility immediately on new members to get them interested and active in the work. Vice-president Martin set as a goal for each member the obtaining of one new member during the months of November and December.

An outline of the activities of the association on behalf of establishing a joint jobber accounting plan under the sponsorship of the California Electrical Bureau was given by the secretary. In this discussion an appreciation of the jobber problems of distribution was evidenced in every statement. It was felt that the Electragists' organization might help to bring about the very necessary co-operation between all jobber organization so essential to any joint action between jobbers and contractors for the improvement of credit conditions.

The Biddle Credit Plan, found so successful in Detroit and recently under consideration for adoption by the building industries of Los Angeles because of its soundness, was offered as a tested and proved method of attacking the credit situation. Full details of this plan will be found on the first two pages of the "Ideas for the Contractor" section of this issue of Electrical West.

Action taken at the convention calls for the creation or extension of jobber contact committees in both the northern and southern divisions. These committees are to take positive steps towards bringing about "less conversation and more action." The principle of the Biddle Credit Plan was endorsed by the convention and recommended to the industry for further study and possible adoption.

T. C. Vickers, vice-president of the I.B.E.W., spoke briefly before the convention adjourned at its noon recess,

Ed Martin, of San Francisco, newly elected president of the California Electragists.

offering the co-operation of the organized labor groups to the aims and load-building programs of the industry.

Merchandising on Afternoon Program

The gavel was turned over to H. H. Courtright, manager of the Valley Electrical Supply Company, to conduct the afternoon merchandising meeting. Most of the discussion centered about a letter addressed by the northern division Merchandising Section to a power company, setting forth matters of policy which the Electragists' group felt would help to improve relations between central station and individual merchant in the sale of electrical merchandise.

This Year's Goal

ONE new member brought into the association by each present member of the California Electragists is the goal that has been set by President Ed Martin and pledged by the association. Each local organization is urged to adopt a similar program. Harry Walker, before retiring from the presidency made the pertinent suggestion that every new member be given responsibilities and be set to work immediately as the best insurance of his continued interest in the association.

The answers made by the central station to the various items were discussed. In each case the point of view of the central station and contractor alike were weighed appreciatively and only certain specific matters were referred back to the merchandising section of both northern and southern divisions for further conference with the central station officials.

Suggestions that detailed reports be made by all members each month as to the amount of load connected brought forth the results of the southern division's experience in the matter, in which it proved exceedingly difficult to obtain a sufficient number of these reports from which to compile data. It was urged by President Walker that contractors take their complaints directly to the highest executives when negotiations with local representatives of power companies fail. Thus to the executives of central stations may be brought a better realization of the problems of contractor-dealers and a more appreciative respect for their work on behalf of the industry at large.

A member was appointed to the recently organized joint central station committee to take up particular problems in merchandising with central station executives.

The cost of wiring, discussed at such length in all meetings of the Pacific Coast Electrical Association and of the N.E.L.A. of late, next came up for discussion. The steps being taken by the P.C.E.A. in the formation of a committee to study wiring costs was outlined and co-operation urged with these committees in every respect. A committee was authorized in both divisions of the Electragists' organization to contact with and assist the P.C.E.A. wiring policy committees to the utmost in their work.

Local Organization Activity

Stronger local association work was advocated rather than scattered state work after a review of results obtained from the previous state educational work of the California Electragists.

"While I still hold the opinion that the most effective permanent work of improving the conditions of the electrical contractors can be obtained through study of the fundamentals of our business, I am coming to the conclusion that this work can be most effectively handled by small groups representing the districts in which the businesses are located." This was the statement of C. J. Geisbush, based on experience of the past year. The possibilities for close and effective work on this plan were outlined in the following activities which could be taken up by local groups:

A central estimating bureau, such as described in ELECTRICAL WEST November, 1928, p. 282, was urged. Such bureaus are now operating in New York, Baltimore, New Orleans, Detroit, Des Moines, Chicago and many other localities, it was brought out.

Cost accounting was urged as the most necessary single activity. Describing how an association could attempt this work, a plan under way in the City of Bakers-

field was enumerated. All contractors in that district not having cost accounting systems in their business at the present time have given orders for such systems to headquarters. Each member will defray the cost of the system and its installation personally but the association will underwrite the expense of a monthly audit.

A third and important matter for local association activity was urged in the support of a bill now being placed before the State Legislature by J. W. Morin, president of the Pasadena Bar Association. Full text of this bill will be published soon. This bill is designed to subject the financing of speculative builders to greater scrutiny and to help guarantee building finance along lines which give the electrical contractor some chance of being paid for his work when the building is completed.

Full endorsement of the Morin bill was made by the assembled convention.

Other local association activities were discussed briefly. Among these were local estimating classes conducted by a rotating chairman and designed to cover types of construction common to that district; cooperative contact on codes and ordinances between local Electragists and inspection departments; advertising campaigns popularizing the name Electragists and designed to create in the minds of the public an appreciation of what the association stands for; participation in the model home activities in which the electric home idea, with particular emphasis upon the Red Seal plan, can be undertaken.

Discussing the matters of particular import to the contracting branch of the industry just now, namely, the change in plan of the national Electragists body from one of combined educational and policy work to policy alone, next came under scrutiny. The national dues of $15 for each member were discussed and a frank discussion of the finances of the association was entered into by the members. No recommendations were made in these matters pending the arrival of further details as to charter arrangements with the A.E.I.

In the election of officers which closed the meeting, Eddie Martin, San Francisco, vice-president during the past year, was named president to succeed H. H. Walker, of Los Angeles. Mr. Martin has been president of the northern division during the past year.

Frank McGinley, president of the southern division, was named vice-president of the state association. C. J. Geisbush was retained as secretary-manager of the association.

The Bakersfield delegation, whose attendance numbered 100 per cent of the local association, asked that the next state convention be held at that city. The matter was referred to the executive committee but recommendation was made that Bakersfield be given preference. The time and place of the next meeting will be announced later. A pen and pencil set was given to H. H. Walker, retiring president, as a token of esteem on the part of the membership.

The Fresno delegation, as hosts for the convention, presented each one in attendance with a basket of grapes. Women who came to the convention were favored with a large basket of fruit.

Motor Sections to Study Franchise Plans

PARALLEL with the afternoon session of the California Electragists' "blue shirt" convention at Fresno, the northern and southern divisions' Motor Sections held their second state meeting of the year.

No set program had been arranged but lively discussion of various motor distribution problems occupied the time.

The most decisive action taken was the appointment of committees in both the northern and southern divisions to make studies of various types of franchise agreements between manufacturers and dealers. Franchise contracts in radio, refrigeration and automobile distribution are to be studied. An attempt will then be made to coordinate the best points of each with a view to working out the best possible franchise agreement to submit in the future.

It was felt generally that the new motor policies announced by manufacturers recently were steps taken in the right direction and that except for minor details, which can be changed as time goes on, should work out satisfactorily.

A definite attempt is to be made to compile specific data on cases of abuse of classifications and of service in order that immediate results can be obtained in rectifying them.

The southern division's section announced that at the Electric Club, Los Angeles, a table was reserved each Monday at which motor dealers met with manufacturers and agents for friendly social contact.

Frank McGinley, of Wilmington, named vice-president of the California Electragists at the Fresno convention. Mr. McGinley was recently elected assemblyman from the 71st district.

Frank Sievers, chairman of the National Motor Section, and a delegate to the national convention from the northern division; and L. H. Ellett, representing the southern division's Motor Section at the convention, made a report of the activities and the policies outlined at that meeting.

Two well located and elaborately furnished radio stores have been opened in San Diego during the past few weeks. **James Urquhart** is handling RCA products at 631 B St., and **John L. Patton** and **W. H. Norton** have opened the **Fairmount Radio Shop**, handling Stewart-Warner products, at 4409 Fairmount Ave.. Mr. Patton was formerly in charge of the **Sunset Electric Company's** radio department, a position now filled by **R. B. Conaughty.** Mr. Conaughty is well known to San Diego electric dealers on account of his former connection with the Pacific States Electric Company.

Announcement of the opening of offices at 814 B St., San Diego, for the sale and promotion of Neon Signs is made by the managers, **F. E. Thurston** and **G. H. Graham**, for the **California Electric Sign Sales Company.**

Veteran Inspector Retires

Edward Hanzel on the floor of the Santa Barbara convention of the California Electrical Inspectors.

Edward Hanzel, pioneer electrical man, and for twenty years with the Department of Electricity of San Francisco, during the last eleven of which he has been chief inspector, retired from the department under pension Dec. 1, 1928. Mr. Hanzel started in the electrical business in 1880 and has been identified with it ever since, first as wireman, later as electrical contractor and for the major part of his career with the San Francisco inspection department.

During all this period Mr. Hanzel has been a vigorous champion of high standards of installation and has had a good deal to do with the ordinance structure in the City of San Francisco pertaining to wiring. His last official acts were in connection with a complete revision and summary of ordinances and local rules of the department (see Electrical West, Nov. 1, 1928, p. 305) for Ralph W. Wiley, chief of the Department of Electricity, under whom he served as chief inspector.

Sam C. Curtis, another pioneer San Francisco electrical man and for many years in the department, takes the position of chief inspector upon Mr. Hanzel's retirement. Mr. Curtis, a native of San Francisco and in the electrical business since his boyhood, first started work with the Department of Electricity in 1911. His first appointment in the inspection department came after some months' work as electrician for the board of works, on the installation of fire and police alarm systems.

Mr. Curtis is well known to contractors of the Bay region and starts his new position with the support of both electrical workers and contractors.

J. E. Chandler recently severed his connection with **Bert L. Perry, Inc.,** and has gone into business for himself under the name of Chandler Electric Company, Los Angeles.

F. E. Enockson, formerly with the **Palmer Electric Company,** Los Angeles, recently joined the staff of the **Industrial Electric Service Company** of Los Angeles.

J. D. Gloria recently established an attractive and selective electrical appliance and radio store at 1344 East Colorado St., Glendale, Calif.

Personals

Washington Co. Official Resigns Post to Travel

AFTER an association of more than 21 years with The Washington Water Power Company, Spokane, **Vincent G. Shinkle**, secretary-treasurer, has announced his resignation, to take effect Dec. 1.

VINCENT G. SHINKLE

The resignation of Mr. Shinkle, which was a distinct surprise to executives and employees of the company, is the result of a decision on the part of Mr. and Mrs. Shinkle to gratify their desire to travel. They plan to spend the winter in California and in the spring will go to Europe.

Mr. Shinkle entered the employ of the company July 1, 1907, as storekeeper. In 1909 he became purchasing agent and on June 1, 1928, he was made secretary-treasurer of the company.

George F. Kinkaid, formerly lighting engineer in the general sales department, Idaho Power Company, has been transferred to the Boise division office as assistant division engineer.

E. G. Stahl, since 1921 San Joaquin district manager, San Joaquin Light & Power Corporation, has been appointed agricultural engineer for the company to carry out the farming diversification program in the San Joaquin Valley outlined by **A. M. Frost**, sales manager. For the past two years Mr. Stahl has served as chairman of the agricultural power committee of the Power and Heating Bureau, P.C.E.A. **De Witt Scott**, power salesman in the San Joaquin district, has been named to succeed Mr. Stahl.

E. C. Brown, for the past 21 years connected with the Ohio Brass Company, Mansfield, has retired from active duty and removed to California. For the last two years Mr. Brown has had supervision of the company's Southwest district.

William Mulholland, chief engineer and general manager, Los Angeles Bureau of Water Works and Supply, has resigned, effective Dec. 1. In presenting his resignation to the board of water and power commissioners he stated that he was 73 years old and desired to rest and leave the duties of his position to younger men in the organization. Mr. Mulholland entered the employ of the City Water Company, the privately owned company then serving Los Angeles, in 1878. In 1886 he was made chief engineer and superintendent, and he was still in that position when the company was bought by the city in 1902. Thus for more than forty years he has been head of the city's water system, and under his supervision the 250-mile Owens River aqueduct was built. **H. A. Van Norman**, assistant chief engineer and general manager, has been appointed to succeed Mr. Mulholland.

Gilbert D. Fish, consulting structural engineer for the Westinghouse Electric & Manufacturing Company, with headquarters in New York, recently visited the Pacific Coast. During his visit he addressed several engineering groups in Los Angeles, San Francisco and Seattle on the use of electric arc welding in steel structural work.

Frank J. McEniry, formerly with the Electrical League of Colorado, Denver, and more recently connected with the Clift Hotel, San Francisco, and well known to members of the electrical fraternity, has been appointed assistant manager of the Palace Hotel of that city.

El Paso Co. Staff Changes Advance Two Men

TWO important changes in personnel have been announced by the El Paso Electric Company, El Paso, Texas. **H. C. Webb, Jr.**, sales manager since March, 1927, has been transferred to the Virginia Electric & Power Company

H. C. WEBB, JR.

as sales manager of the Richmond division. He has been succeeded by **J. H. Warden**, sales manager for the Louisiana division of the Gulf States Utilities Companies, Lake Charles, La.

Mr. Webb was first employed by the El Paso company as general salesman in June, 1921, going there from Houston. Later he became illuminating engineer and held that post until January, 1925. In September of the following year he was promoted to the position of sales manager for the Baton Rouge Electric Company and a year later was transferred to Lake Charles, La., as superintendent of sales for the Gulf States Utilities Companies, Louisiana division. He remained there until March, 1927, when he was recalled to El Paso to become sales manager for the company.

Mr. Warden is returning to a familiar field, for prior to his transfer to Lake Charles, he was acting sales manager

J. H. WARDEN

for the El Paso company, and had spent five years in that company's employ, which he entered in June, 1922. A short time after that he was transferred to the sales department as power sales engineer. In September, 1925, he was made assistant sales manager, and later became acting sales manager.

Will H. Fischer has been made assistant to the president of the Southern California Edison Company. Mr. Fischer began his business career in newspaper work and has continued to maintain an active interest in public affairs. In the summer of 1899 he began work on San Francisco papers and continued in newspaper work in that city for several years. In 1911 he became editor of the "California Outlook," a weekly published in Los Angeles. That post he resigned to become an editorial writer on the Los Angeles Evening Express and the Morning Tribune and continued in that work until he joined the Taxpayers Association of California in an executive capacity. Since joining the Edison company in 1921, Mr. Fischer has been very close to Mr. Ballard in all matters bearing upon public relations.

R. E. Fisher, vice-president in charge of sales and public relations, Pacific Gas and Electric Company, in his capacity as director of the California Development Association and chairman of its aviation committee, recently demonstrated to the local Rotary Club by means of stereopticon slides and graphs how the team work of California communities is responsible for the outstanding growth of the state during the last decade.

A. J. Lutz Is President of Seattle Electric Club

THE Seattle Electric Club has a new president in the person of **A. J. Lutz**, manager of the Seattle branch of the Pacific States Electric Company.

A. J. LUTZ

He succeeds **R. M. Boykin**, manager of the Seattle division of the Puget Sound Power & Light Company.

Twenty-seven years ago Mr. Lutz entered the electrical industry at the age of fourteen as errand boy at the California Electric Works, the predecessor of the Western Electric Company in San Francisco. He held various positions with that company for four years and then left to join the John M. Klein Company. After the earthquake and fire in 1906 he was placed in charge of the stock department of the Century Klein Electric Company and remained until 1908 when he became a salesman for the Sterling Electric Company, the forerunner of the Pacific States Electric Company. He went on the road for that company and continued in that work until September, 1922; then he was appointed district manager of the Oakland office. A year later he was transferred to Seattle to become manager of the company's branch there.

Mr. Lutz has had previous experience as president of an electric club, for while he was in Oakland he served in that capacity for the Oakland organization. Mr. Lutz seems to be making a collection of presidencies, for since his election as head of the Electric Club, he has been named president of the Radio and Music Trades Association of Seattle, succeeding **W. M. Graham**, of the Hopper-Kelly Company.

Claude Noble, formerly with the Puget Sound Power & Light Company, Renton, Wash., now is associated with the Tampa Electric Company, Tampa, Florida.

Ethel Peffer, staff secretary of the Electrical League of Colorado from the date of its organization in July, 1921, until March, 1925, has resumed her former duties in that office. For the past two and a half years Miss Peffer has been assistant to **Bernhard Badrian**, supervisor of Red Seal promotion, Society for Electrical Development, New York City.

Harold Michener, of the executive engineering department, Southern California Edison Company, has been appointed to head a newly created department which will have complete charge of all matters connected with the selection and handling of poles in and out of the company's store stock. The proper administration of the large amount spent annually for poles and the rapid advancement of knowledge of pole selection and treatment which recent years have shown make the employment of an expert for this particular line of work timely, according to the announcement of **F. B.. Lewis**, vice-president and assistant general manager.

Miss Elsie Lindstrom, of the purchasing department, Southern Colorado Power Company, was recently appointed chairman of that company's women's committee.

A. C. Hackstaff has succeeded **F. S. Rutherford** as district sales agent of the Youngstown Sheet & Tube Company in Denver.

Reinier Beeuwkes, electrical engineer for the Chicago, Milwaukee & St. Paul Railway, with headquarters in Seattle, was selected as a member of the National Electric Light Association's committee of four engineers to study and report on the various important European railway electrifications and the power plants serving them. The engineers sailed from New York on Oct. 27.

J. M. Rowland, of the Hooker Electrochemical Company, and A. R. White, of the Tacoma Electrochemical Company, were the speakers at the recent meeting of the Tacoma Engineers' Club. Mr. Rowland spoke on "The Electrochemical Process," and Mr. White on "Marketing Their Products."

Les Rubles, of the North Coast Electric Company, Seattle, has been elected president of the local Sales Managers' Club.

John E. Richardson, formerly with the Jobbers Supply Company, Seattle, is now with the Triangle Conduit Company in that city, under the supervision of **H. H. Manny.**

Sam P. Russell, president, H. B. Squires Company, San Francisco, spent the greater part of the month of November visiting factories which his firm represents. He is expected to return about the first week in December.

Wesley E. Wright, formerly transmission line dispatcher, El Paso Electric Company, El Paso, has been made assistant to the superintendent of distribution.

H. H. Hunt, Stone & Webster, Inc., Boston, recently visited Seattle on an annual survey of the affairs of the Puget Sound Power & Light Company.

Andrew Lund, foreman of The Washington Water Power Company's Monroe St. power station, Spokane, and **Louis Englebart**, foreman of its Nine-Mile power station, are rounding out the fortieth year of their service in the employ of that company. In seniority they rank next to **John B. Fisken**, consulting engineer, who has completed his forty-first year of service.

W. D. Johnston to Lead Wyoming Utilities Assn.

AT THE recent convention of the Wyoming Utilities Association held in Casper, **W. D. Johnston**, general manager of the Mountain States Power

W. D. JOHNSTON

Company's Wyoming division, was elected president. He served as first vice-president during the past year.

Mr. Johnston, who bears the distinction of being one of the youngest utility company executives in the Rocky Mountain region, started his electrical experience in 1909 with the Telluride Power Company of Utah. Following his winning of a scholarship awarded by the Telluride Association, the educational foundation established by L. L. Nunn in connection with Cornell University, Mr. Johnston went to college and was graduated in 1917 with the degrees of A.B. and M.E. After graduation he spent three years as designing and power engineer for the Bell Telephone Company of Pennsylvania and then became general superintendent of the Natrona Power Company at Casper. Mr. Johnston continued with the company when, together with its subsidiaries, it was acquired by the Byllesby interests, and became general manager when it was made the Wyoming division of the Mountain States company.

Obituary

Samuel H. Batten, for 29 years auditor for the Pacific States Electric Company, San Francisco, died in that city Nov. 12.

William F. Nordholt, assistant district manager for the Southern California Edison Company in the Santa Monica district, died suddenly in that city Nov. 18.

Margaret E. Sayer, vice-president, Kaffer-Chapman Electric Company, Denver, wife of the late William E. Sayer, who founded the business 35 years ago, died in that city Nov. 11.

Meetings

Coming Events

Pacific Division, National Electrical Wholesalers Association—Annual meeting at Hotel Del Monte, Del Monte, Calif., Jan. 31-Feb. 2, 1929.

California Electrical Bureau—Meeting of advisory committee at Jonathan Club, Los Angeles, Jan. 7, 1929.

Pacific Coast Electrical Association—Annual convention at Hotel Del Monte, Del Monte, Calif., June 19-22, 1929.

Engineering Section—Conclave in Los Angeles, Jan. 16-18, 1929.

Clark Baker Discusses Art of Home Lighting

Clark Baker, lighting specialist of the National Lamp Works of the General Electric Company, Oakland, Calif., spent the week of Nov. 12 in Salt Lake City and nearby cities where he spoke on the modernistic trend in the art of home lighting.

The first talk was presented at the Newhouse Hotel in Salt Lake City before a gathering of members of the electrical industry. Mr. Baker first spoke of the function of the human eye in its relationship to light, and pointed out, by the use of drawings and charts, the manner in which this important organ responds to various lighting effects. He also explained the principles of color combinations by means of color charts. Enlarged photographs of children, engaged in study both at home and at school, brought out forcefully the evils of improper lighting and its injurious effects on the eyesight.

Mr. Baker exhibited drawings and charts illustrating his discussion of the development of artificial lighting from its earliest stage up to the present time. In entering upon his discussion of the modernistic trend in lighting, the speaker pointed out that the ideas and the illustrations which were to be presented were not in the nature of definite recommendations but were wholly for the purpose of bringing to his audience some impression of what is being done, and can be done, in keeping the electrical industry in step with the progress that is taking place in the modernistic trend of today.

This meeting was handled by the Lighting Service Bureau, of Salt Lake City. E. A. Evans, of the Westinghouse Lamp Company, presided as chairman.

Similar lectures were presented by Mr. Baker in Salt Lake City before a public audience of women, before the Home Economics Department of the University of Utah, and before the Lions Club. At Provo he addressed the students of the Brigham Young University, and in Ogden he gave a talk to members of the electrical industry and a number of architects.

In his talks before the electrical fraternity Mr. Baker emphasized the necessity for the fixture manufacturer and dealer to grasp the opportunity to develop new ideas along these lines and capitalize on the resultant possibilities for increased business. Mr. Baker also stressed the point that all branches of the industry are vitally interested in this situation, as every installation of any sort means an additional market for the materials making up its component parts.

During this series of addresses Mr. Baker delivered his message to a total of approximately 1,200 people, and it was exceptionally well received. The Electrical League of Utah, in conjunction with the Lighting Service Bureau, sponsored the entire program.

Bureau Advisory Committee to Meet—A meeting of the advisory committee of the California Electrical Bureau will be held in the Jonathan Club, Los Angeles, Jan. 7, 1929.

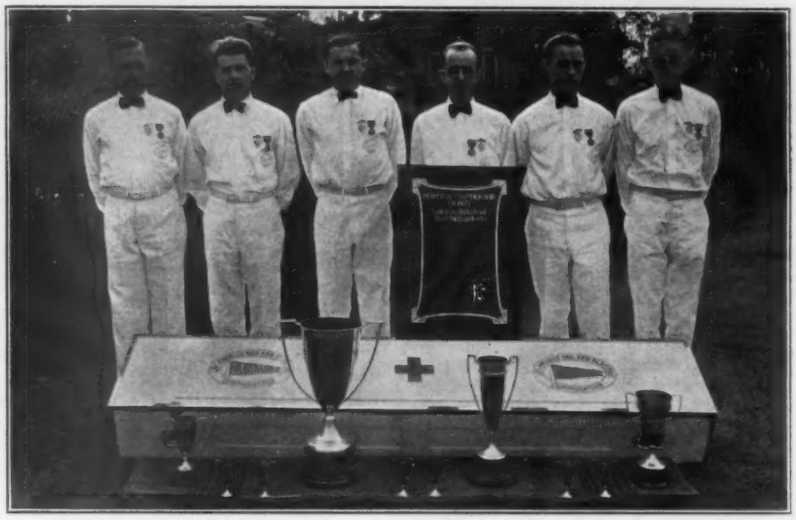
Wholesalers to Hold 3-Day Meeting at Del Monte

Announcement has been made by Albert H. Elliot, secretary, that the annual meeting of the Pacific Division, National Electrical Wholesalers Association, will be held at the Hotel Del Monte, Del Monte, Calif., Jan. 31-Feb. 2, 1929.

Mr. Elliot states that this will be the most important meeting of the year, and the association is anxious to have every wholesaler and every manufacturer represented at the convention and all central station men present. Election of officers will be held, and a fine program is being prepared centering around some of the vital questions which are now being discussed involving wholesalers throughout the country.

One of the features of the convention is to be the entertainment planned for the ladies, and there will be some exceptionally interesting announcements made with respect to the golf tournament.

So They Took All High Honors and Went Home



LADEN with medals and loving cups, the First Aid Team of the Los Angeles Gas and Electric Corporation's Pasadena district returned from the Fifth Annual Pacific Coast Safety Conference held in San Francisco under the auspices of The Society of Safety Engineers, the California State Division of Industrial Accidents and Safety, the U. S. Bureau of Mines, the National Safety Council and the American Red Cross. Competing against eighteen teams, the Pasadena team won first place in the main contest, took first place in the Public Service Division, and won the special prize for resuscitation work.

When the numerous prizes were presented at the annual banquet which closed the meeting, the Los Angeles Gas and Electric Corporation's representation was awarded the following trophies: a metal plaque, presented by The Society of Safety Engineers; the E. D. Bullard Perpetual Cup; six miniature cups, one for each team member; six silver medals of the American Red Cross; six twenty-dollar gold pieces awarded by the Society of Safety Engineers; the silver cup of the Public Service Division; and the silver cup for the resuscitation problem.

Presentation of the cup awards was made by E. W. Bullard, of the E. D. Bullard Company, San Francisco and Los Angeles, who served as director of the contest. The American Red Cross certificates were presented to the winners by E. H. Carroll, assistant national director of the First Aid and Life Saving Section, and W. D. Keefer of the National Safety Council presented the medals from that organization.

The members of the team are (left to right)—H. L. Eyer, L. L. Kullgren, J. A. Schneider, Jr., H. F. Lougee, captain, M. N. Worthington, and P. W. Jacobson.

San Joaquin Power Club Elects New President

Activities of a new year have been started by the San Joaquin Power Club, employees' organization of the San Joaquin Light & Power Corporation, under the leadership of James S. Heaslett of the Fresno district. Mr. Heaslett was elected president of the

JAMES S. HEASLETT
President of the San Joaquin Power Club.

Fresno Chapter, which automatically makes him president of the entire club, at the recent annual banquet and election of officers. The system-wide club, organized this past year, now has a membership of approximately 1,200.

Presidents who will lead the activities of the other Power Club chapters for the coming year include R. F. Henderson, San Luis Obispo; T. S. Harness, Merced; A. G. Bell, Dinuba; A. Kron, Corcoran; R. C. Barnes, Bakersfield; A. P. Minner, Taft; H. M. Phillips, San Joaquin; and Hugh Staley, Los Banos.

Christmas Tree Campaign Sponsored by Club

An outdoor Christmas tree campaign, sponsored by the Electric Club of Seattle, is being developed by a committee headed by Harry J. Martin, National Carbon Company, and including E. A. Will, Allied Industries, Inc.; Charles Cutter, Pacific Electric Manufacturing Company; George Thirsk, electrical engineer; Norman O'Farrell, Edison Lamp Works; and Joe Osier, editor of R.P.M., the club's official organ. The preliminary plans indicate a successful campaign, as the central station, jobbers, dealers, Park Department and various oil companies have agreed to co-operate in the movement.

The club recently made up a party of 50 of its members and journeyed to Bremerton, the Puget Sound Navy Yard, for an inspection trip through the airplane carrier "Lexington."

Arizona Electrical League Plans Christmas Lighting—The Salt River Valley Electrical League, with headquarters in Phoenix, Ariz., met Nov. 19 to discuss plans for Christmas lighting. It was decided to light the streets of Phoenix for many blocks in all directions from the heart of the city. The city will be divided into four sections, which will compete for prizes for the best decorated block and home in each section. Various service clubs are assisting in furnishing small groups to sing Christmas carols before the lighted homes throughout the week.

Utah League Plans Christmas Lighting Contest—Plans are now under way for another Christmas lighting contest in Salt Lake City, under the sponsorship of the Electrical League of Utah. This activity will be conducted along lines similar to those of the past three years, with an increased number of prizes, and it is anticipated that it will take on a broader scope with a greater response even than last year's highly successful event. M. L. Cummings, Jr., of the Utah Power & Light Company, again has been appointed chairman of the committee in charge of the contest.

Manufacturer & Distributor

Officers and Employees to Buy Graybar Company

Effective Dec. 31, 1928, arrangements have been concluded for the purchase of the **Graybar Electric Company** by its employees from the Western Electric Company. The ownership of the company will be in the hands of the **Graybar Management Corporation,** which was recently organized to enable the officers and other employees of the Graybar Electric Company to purchase the business. All of the capital stock of the Graybar Management Corporation will be owned by the officers and other employees of the Graybar Electric Company. The management will continue as at present.

Under its new ownership the Graybar Electric Company will be capitalized at $9,000,000, consisting of $3,000,000 in common voting stock and $6,000,000 in preferred non-voting stock. The entire common voting stock will be owned by the Graybar Management Corporation.

In consummating this sale and purchase agreement, provisions have been worked out that will insure to the present Graybar employees the perpetuation of the pensions, sickness and other benefit plans which they enjoyed while in the employ of the Western Electric Company or the Graybar Electric Company up to Dec. 31, 1928.

Pelton Turbines for Power House at Coolidge Dam

Contract has been awarded **The Pelton Water Wheel Company,** San Francisco, by the U. S. Indian Irrigation Service, Department of the Interior, for two vertical reaction turbines for installation in the Coolidge Dam power house. The turbines are designed for variable head operation, 140 ft. to 220 ft., to develop 9,200 hp. each and are to be furnished complete with governor actuators and oil pressure systems.

The Coolidge Dam, which is being built on the Gila River in Arizona, will impound 1,200,000 acre-ft. of water and is second in size only to the Roosevelt Dam on the Salt River in Arizona. It is the first dam of the multiple-dome type to be built.

Another order recently placed with the Pelton company is that of the Patterson Water Company, Patterson, Calif., for 21 Moody spirel pumps. The pumps are to be direct-driven by motors furnished by the **General Electric Company,** which is also supplying all other electrical equipment.

Sangamo Electric Company Opens Arizona Office—In order to give the best possible service to the Arizona territory, the **Sangamo Electric Company,** Springfield, Ill., has opened an office at 218 Security Building, Phoenix, in charge of J. E. Redmond, district manager. A complete stock of both 25 and 50-cycle meters, clocks and radio transformers will be carried at that point. As in the past, the Sangamo company will continue its offices at 1061 Howard St., San Francisco, in charge of L. A. Nott, district manager, and 750 Subway Terminal Building, Los Angeles, with J. G. Monahan, district manager.

General Electric Company Buys Intermountain Concern—Announcement has been made that **The Mountain Electric Company,** 1433 Lawrence St., Denver, has been purchased by the General Electric Company and will continue as a strictly wholesale business upon the same high standard as that set by the predecessor company but on a larger scale, under the name of the **General Electric Supply Corporation.** An extensive program of expansion is already well under way. The management remains the same with John J. Cooper as general manager, and the addition of the following new departments, headed by former Mountain Electric Company men: financial—E. B. Langley; sales—L. B. Johnson; service—E. D. Heintze.

Westinghouse Co. to Supply Ferry Boat Equipment

Contract to furnish electric propelling equipment for a new passenger and auto ferry has been awarded the Westinghouse Electric & Manufacturing Company. The boat is to be built by the Moore Dry Dock Company, Oakland, for the Spreckels' interests which operate the San Diego & Coronado Ferry Company, and will ply between San Diego and Coronado.

This all-steel ferryboat will have two Atlas Imperial 8-cylinder, 500-hp., four-cycle engines direct-connected to Westinghouse generators and exciters. There will be two propelling motors of 750 hp. each, one at each end of the ferryboat.

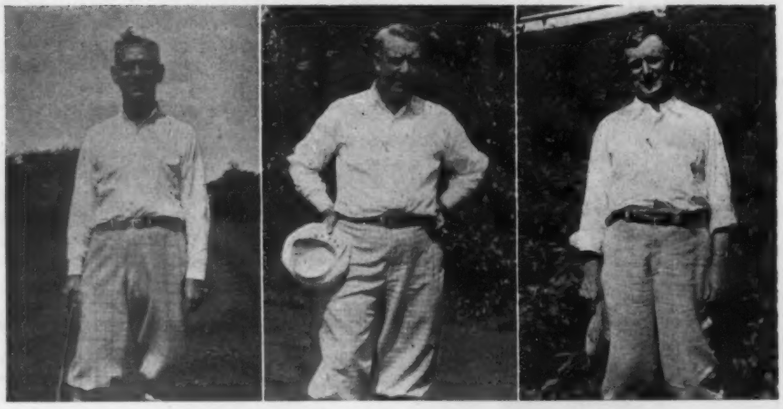
Eastern Official Confers with Western Representatives—Max Scott, assistant general manager, **I-T-E Circuit Breaker Company,** Philadelphia, accompanied by Mrs. Scott, spent several weeks in November in Western territory, following a journey through the Panama Canal. During his sojourn in the West Mr. Scott conferred with the various representatives of his company, spending a week with The Demmert Company in Los Angeles, and with Jones-Lyman, Inc., San Francisco. He then went on north and conferred with Burton R. Stare, Seattle, N. D. Blagdon Phillips, Vancouver, B. C., and returned East via Denver, where he spent a week with Joy & Cox.

To Supply Equipment for Fire Alarm System—Complete central station equipment will be supplied by the **Diamond Electrical Manfuacturing Company,** San Francisco and Los Angeles, for a new fire alarm system to be installed by the City of Tacoma. Changes in the system include installation of 100 new boxes and rebuilding of about 300 old boxes and the erection of a new fire alarm station. The installation will be made under the direction of Lewis Degen, consulting electrical signal engineer, with the assistance of C. L. Thompson, superintendent of fire alarms of Tacoma.

Wagner Corporation Moves Los Angeles Branch—The Los Angeles branch office and service station of the **Wagner Electric Corporation,** has been removed to 1220 South Hope St. The removal involves all local departments.

Joins Appleton Company—Albert W. Rockwell, formerly in charge of the San Francisco office of the Chicago-Jefferson Fuse Manufacturing Company, now is associated with the San Francisco office of the **Appleton Electric Company,** 655 Minna St., San Francisco.

Three Wise Men Out of the West



When the annual sales convention of the **Electric Vacuum Cleaner Company, Inc.,** Cleveland, was held at Association Island, N. Y., thirty factory officials and division managers were present. From the West went three division managers, who apparently took a prominent part in the golfing activities of the meeting. From left to right they are: C. A. Pearl, Portland; C. J. James, Los Angeles; and L. W. Brownrigg, San Francisco.

Eastern Factory Executives Visit Coast Representative—Executives of three Eastern factories represented on the Pacific Coast by **Maydwell & Hartzell, Inc.,** San Francisco and Los Angeles, recently paid visits to the West and conferred with their representative while in Coast territory. The visitors were S. N. Comly, of **Russell, Burdsall & Ward Bolt & Nut Company,** Port Chester, N. Y., with headquarters in Chicago; James R. Kearney, president, **James R. Kearney Corporation,** St. Louis; and J. V. Patterson, sales manager, **Porcelain Products, Inc.,** with headquarters at Findlay, Ohio.

Pacific Coast Manager Becomes Vice-President—A. W. Thompson, since 1926 Pacific Coast manager for **Fairbanks, Morse & Company,** Chicago, has been elected a vice-president of that organization. He will continue to have charge of Pacific Coast business for the company.

Is Manager of Oakland Shop—Morris L. Foster, formerly commercial agent, Coast Counties Gas & Electric Company, Santa Cruz, Calif., is now manager of the **Hot-n-Kold Shop,** Oakland, Calif. Frank Cronin, formerly with the Western States Gas & Electric Company, Richmond, Calif., has been named as Mr. Foster's successor in the Coast Counties Company.

Appointed Representative of Miller Division in Eleven Western States—J. M. Atwood, connected with **The Miller Company,** Meriden, Conn., during the past four years, has been appointed Pacific Coast representative of the Miller Division of The Miller Company with jurisdiction over the eleven Western states. He will make his headquarters at 50 Hawthorne St., San Francisco.

Former G. E. Man Heads New Concerns—J. O. Case, until recently assistant manager of the Los Angeles office of the General Electric Company, in company with others has organized a new firm known as **J. O. Case, Inc.,** with headquarters at 1630 West 7th St., Los Angeles. The concern will handle Servel and Electrolux refrigerators in Los Angeles and vicinity.

American Circular Loom Company Adds Denver Representative—F. C. Hodkinson, vice-president and general manager, **American Circular Loom Company,** 90 West St., New York City, has announced that Paul A Douden & Company, 1708 Sixteenth St., Denver, has joined that company's selling organization and will look after its line of "better wiring materials" throughout the Denver and Salt Lake territory.

Seattle Firm Takes Larger Quarters—**The Caldwell Electric Company, Inc.,** which for the past three years has been established at 2762 First Ave., South, Seattle, has removed to larger quarters affording more display space at 2737 First Ave., South. The company is headed by C. S. ("Chuck") Caldwell.

Incorporates Under New Name—The former Baker Electric Company has been incorporated with a capital of $100,000 and is now known as **The Associated Wholesale Electric Company** with headquarters in Los Angeles.

Becomes Sales Engineer for Wesix, Inc.—Glenn Riggs, formerly connected with the Pacific Gas and Electric Company, San Francisco, has joined **Wesix, Inc.,** as sales engineer for its San Francisco division.

New Equipment

Wall Outlet Range

The illustration shows the new wall outlet electric range recently offered to the trade by **The Armstrong Electric & Manufacturing Corporation,** Huntington, W. Va. It is a full-sized,

large-family range and operates from any convenience outlet, the manufacturer announces. It occupies a space only 26¾ in. from front to wall, 23 in. wide and 40 in. high.

Some of the more important features are: Two Chromalox 660-watt reflector-type top elements; oven temperature indicator; oven size 14 x 14 x 19½ in., with two 660-watt elements and correct oven insulation by means of dead air spaces, warming shelf, and convenient switch panel.

The range is easily cleaned and because of compact size and light weight may be easily moved about. It has a capacity of 1,320 watts, using one cord attached to one wall outlet. Where two outlets are available from two different house circuits the capacity of the range may be doubled through a simple change in the switch panel wiring. The range requires no special wiring.—Electrical West, Dec. 1, 1928.

Junior Electric Irons

Three light-weight electric irons are being featured by the **Dover Manufacturing Company,** Dover, Ohio. They are,

respectively, the Bonnie Dover, with a leatherette carrying bag for traveling, the Dover Lingerie, for women's dainty things; and the Dover Co-ed, for the girl at school. These irons use less current, are lighter to handle, reach just the right temperature for silks and laces, can be used in a small space anywhere in the house, and do not require a heavy ironing board.

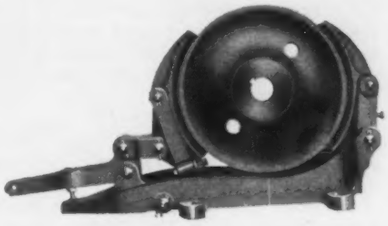
These Dover Junior irons are sold to the dealer in packages of twelve, two Bonnie Dovers, six Dover Lingeries and four Dover Co-eds in each package. Handles and cords are in assorted colors, red, green and black handles and red, green and blue cords making an attractive display and set-up on the handsome five-color display stand which is enclosed in each package of twelve irons, together with a three-foot, five-color window streamer. In addition, each package contains a complimentary box of twelve toy irons, miniatures of the Lady Dover electric iron, to sell at 25 cents each.

Prices of the Dover Junior irons range from $1.95 to $3.75.—Electrical West, Dec. 1, 1928.

Mechanically Operated Brake

Announcement of Type WB brake arranged for lever operation has been made by **The Electric Controller & Manufacturing Company,** 2700 East 79th St., Cleveland.

This brake is of the shoe type and is intended for the bridge drives of electric traveling cranes, lift bridges, electric hoists and other applications re-



quiring foot-operated or hand-lever operated brakes. It is a modification of the company's Type WB electrically operated brake; practically all wearing parts of the new mechanically operated brake are interchangeable with parts of the electrically operated brake.—Electrical West, Dec. 1, 1928.

De Luxe Gift Boxes—On the theory that merchandise properly displayed is half sold, **Landers, Frary & Clark,** New Britain, Conn., have made up sample display packages for their toasters and coffee percolators. The toaster box is attractively finished in black and gold with figured tan silk lining, and the percolator boxes are finished in an unusual blending of rose, blue, yellow and gold and lined with blue silk of attractive pattern. Percolators are equipped with blue silk cord to match. —Electrical West, Dec. 1, 1928.

Boundary and Obstruction Light

A new Department of Commerce standard boundary and obstruction light has been announced by the **Holophane Company,** 342 Madison Ave., New York City. This is a special screw-type globe with refracting prisms on the inside of the globe. The candlepower of the lamp is increased in all upward directions. No. 02203 is the small size for lamps from 15 to 50 watts; No. 02323 is the large size for 100 and 150 multiple lamps and 600-1,000 lumen series lamps. Both globes are made of crystal, red, green and amber glass.—Electrical West, Dec. 1, 1928.

Fruit Juice Extractor

For homes, hotels, restaurants, hospitals, soda fountains, or any other place where fruit juices are served, the

Signal Electric Manufacturing Company, Menominee, Mich., is offering a fruit juice extractor which it claims extracts 25 per cent more juice than the old hand method and is quicker and cleaner. It is finished in French gray with stainless aluminum cup and is equipped with a Universal motor which is fully protected from moisture and will not throw out the juice, according to the maker.—Electrical West, Dec. 1, 1928.

Auxiliary Landing Field Light

Announcement of a new auxiliary landing field light which employs only a 2,000-watt lamp has been made by the **B. B. T. Corporation,** Atlantic Bldg., Philadelphia.

It is called by the makers a dual purpose light, because of the fact that it can be mounted on top of the regular air mail type M-8-D or intermediate air mail type H-8-D landing floodlights. It can also be used for temporary illumination prior to the necessity for installation of a major floodlighting system and for the illumination of areas between the hangars and the lighted field given over to the handling and maneuvering of ships, passengers, mail and express. The light employs the Fresnel handcut lens for the 180-deg. distribution of light. This lens cuts off the top of the light beam sharply.—Electrical West, Dec. 1, 1928.

Lantern Floodlight

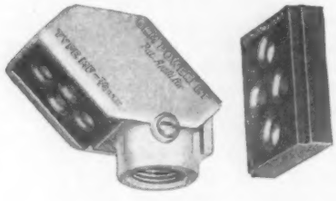
The Golden Glow lantern floodlight, manufactured by the **Electric Service Supplies Company**, Seventeenth and Cambria Sts., Philadelphia, consists of a complete floodlight unit mounted within an ornamental street lantern. It provides a modern floodlight for locations where the installation of the ordinary type of floodlight unit would be unsightly, and it makes possible the floodlighting of a building where the space available for lighting equipment is limited to a 10-ft. sidewalk.

The lantern floodlight is furnished in two sizes, one with a 9-in. diameter reflector in which 300 or 500-watt lamps may be used; the other with 14-in. diameter reflector in which 750, 1,000 or 1,500-watt lamps may be used.

The lamp socket is rigidly fastened to the reflector, thus assuring proper focus at all times. The lamp bulb and reflector are adjustable. At the base of the lantern a socket is provided for a 200-watt lamp which serves for general illumination of the lantern.—Electrical West, Dec. 1, 1928.

Service Entrance Fitting

Ease of assembly, maximum wiring space and only one locking screw are features of a new type MF Gem



Powerlet service entrance fitting, recently announced by **Chicago Jefferson Fuse & Electric Company**, 1500 South Laflin St., Chicago.

The announcement reads in part: "Assembly is simple. Screw the base onto the conduit. When cap is removed the wires can be pulled through the conduit with a straight line pull. Pass the wires through the cover and replace the cap. The cover is so placed that the wires can readily pass through the holes without extreme bending. One brass screw, which is not removable and cannot be lost, locks the cap cover and base firmly together."

This fitting is made in ½, ¾, 1 and 1¼-in. sizes with galvanized finish, and it is listed as standard by the Underwriters' Laboratories.—Electrical West, Dec. 1, 1928.

Simplex Line of Appliances Now Complete—By the addition of a six-cup percolator, waffle iron, "Toast-Turner" toaster, immersion heater, low-priced electric iron, domestic soldering iron, curling iron and twin hotplate, the Simplex Division of the **Edison Electric Appliance Company, Inc.**, 5600 West Taylor St., Chicago, now offers dealers a complete assortment of appliances bearing the Simplex name.—Electrical West, Dec. 1, 1928.

Doughnut and Fry Kettles—For all commercial "deep fat" frying operations, the **Edison Electric Appliance Company, Inc.**, 5600 West Taylor St., Chicago, has added to its line electric doughnut and fry kettles. They are built to meet the demands of continuous heavy service under the most severe operating conditions. The K14 (non-automatic) or the KA14 (automatic) kettles are designed particularly for use in bakeries for the frying of doughnuts, crullers and similar foods. The K15 (non-automatic) and the KA15 (automatic) kettles are adaptable for all "deep fat" operations.—Electrical West, Dec. 1, 1928.

Portable Light

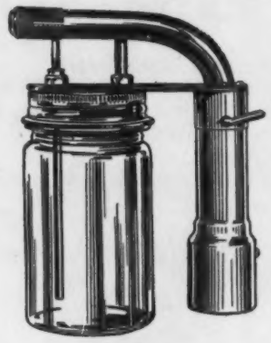
Cordlite, a portable extension light being marketed by **The Belden Manufacturing Company**, 2300 South Western Ave., Chicago, has a soft rubber safety

handle socket which is durable, waterproof, and prevents possibility of shock to the user, the manufacturer states. A Belden soft rubber plug that will stand all sorts of rough treatment without harm is provided, and a Beldenlac cord with an attractive lacquer finish is used.

The same company is offering a new extension cord with a floor-type outlet which sets flat on the floor and makes a very neat installation. A Belden soft rubber plug is also furnished with this cord.—Electrical West, Dec. 1, 1928.

Sprayer Attachment

Designed primarily for use with the "Premier Duplex" cleaner, the sprayer attachment brought out by the **Electric Vacuum Cleaner Company, Inc.**, Cleve-



land, can be made to fit practically every household cleaner.

An outstanding feature of the new sprayer is its nozzle construction, which permits accurate and positive adjustment of the spray according to the work to be done. A coarse or heavy spray can be changed instantly to a fine mist, which is necessary when a very smooth finish is desired. The intended retail price is $3.50.—Electrical West, Dec. 1, 1928.

Wristogrip Puller

An addition to its lines of specialties has been made by the **W. N. Matthews Corporation**, St. Louis, in its No. 1375 Wristogrip Puller, which provides a quick and safe method of disconnecting and closing switch blades, or removing and replacing fuse cartridges on open-type fuse and disconnecting switches of all types and makes. These operations can be quickly and easily performed by the operator while standing on the ground, or on a truck or platform; it makes unnecessary the climbing of poles to reach the switch.

The Wristogrip Puller is really an extension of the hand and wrist. It is raised to the cartridge or blade with the hand-like gripping mechanism open; to close the "thumb," the operator turns the pole to the right; when a secure grip is obtained he pulls down on the pole. The wrist movement keeps the pole always at the same angle, but allows the gripping mechanism to turn with the downward movement of the cartridge or blade.—Electrical West, Dec. 1, 1928.

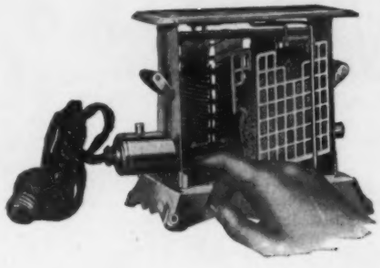
Automatic Welder—An automatic tractor type arc welder utilizing the electronic tornado principle and used for making lap welds and butt welds on large tank bottoms and roofs, large pipe and on similar work, has been placed on the market by **The Lincoln Electric Company**, Cleveland, Ohio. The chief advantages claimed for this machine are high welding speeds and smooth uniform welds. Speeds on ¼-in.-lap joints varying from 50 to 75 ft. per hour are obtained.—Electrical West, Dec. 1, 1928.

Electric Desk Lamp

Announcement has been made by the **Eagle Electric Manufacturing Company**, 59-79 Hall St., Brooklyn, N. Y., that it has added to its line two electric desk lamps, Nos. 395 and 396. Both are furnished with 6-ft. cords and attachment plugs, and the flexible arm of each permits adjustment to any angle. No. 395, which may be obtained in Verdi green, mahogany or antique bronze finish, lists at $2.50. No. 396,

which is equipped with a removable glass ash tray, is finished in either antique bronze or Verdi green and lists at $3.75.

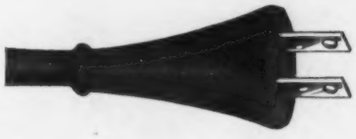
A third product recently added to its line by this company is a reversible toaster, No. 345. This toaster, which is provided with a horizontal reversible



mechanism for turning the toast without the necessity of touching it with the fingers, is finished in nickel plate with a choice of blue, red or yellow handles. It is equipped with 6-ft. cord, attachment plug and has a handy control switch right on the toaster. The list price is $5.—Electrical West, Dec. 1, 1928.

All-Rubber Cord Set

An all-rubber cord set, with flexible rubber cap molded on one end and with



the other end stripped ready for wiring, is being manufactured by **The Bryant Electric Company**, Bridgeport, Conn. These come in 10, 20 and 30-ft. lengths with No. 16 and No. 13 "Junior" all-rubber cord.—Electrical West, Dec. 1, 1928.

Recent Publications

Motor-Operated Cam Controllers—Leaflet 20374, published by the **Westinghouse Electric & Manufacturing Company**, East Pittsburgh, describes its class 13-300 motor-operated cam controllers. These controllers are designed for secondary control of wound rotor induction motors, carrying 250, 500 or 800 rotor amp. at 1,000 secondary volts. They are made with either 13 or 23 contact points.

Floodlight Lantern—Golden Glow lantern floodlights, manufactured by the **Electric Service Supplies Company**, Seventeenth and Cambria Sts., Philadelphia, are described in two circulars recently issued by the company, No. 257, "Illumination of Gasoline Service Stations," and No. 259, "Golden Glow Lantern-Floodlights."

Outdoor Lighting Equipment and Lanterns—A profusely illustrated booklet on this subject has been published by the **Artistic Lighting Equipment Association**, 711 Graybar Building, New York City. It gives the origin and development of the lantern, and indicates the artistic and decorative possibilities, as well as utilitarian advantages and protective features of exterior lighting, according to the announcement. Copies will be mailed free upon request.

Single-Phase Motors—Bulletin 157, describing and illustrating its RA single-phase repulsion-induction motors, has been issued by the **Wagner Electric Corporation**, 6400 Plymouth Ave., St. Louis. Not only is the motor dissected to make clear to motor users what each part of the motor is for and why it is made that way, but the bulletin is also a textbook on single-phase motors in general, covering such subjects as type of single-phase motors, history of repulsion-induction motors, operating principles, sleeve and ball bearing construction, ventilation, and construction features of stator, end plate, rotor and rocker arm. Copies will be sent free upon request.

Electric Heat in Factories—Bulletin GEA-1012, entitled "Electric Heat in General Electric Factories," contains illustrations and descriptions of some of the typical installations and processes in factories operated by the **General Electric Company**, Schenectady, N. Y. Reasons for the use of electric heat are briefly stated. The electric heating apparatus discussed includes furnaces, ovens, impregnating tanks, melting pots, galvanizing tanks and localized heating units and portable devices.

Residence Water Systems—An illustrated, 16-page catalog (Edition F) of the D-L electric residence water systems manufactured by the **Delco-Light Company**, General Motors subsidiary of Dayton, Ohio, lists the entire line of D-L residence and deep well pumps, together with accessories. Several pages are given over to the conveniences of running water, layouts of plumbing installations, methods of fire prevention and a diagram for a sewage system for rural and suburban homes. D-L water systems are designed to operate from either alternating current or electricity from Delco-Light individual farm electric plants, also made by the Delco-Light Company.

Worthington Equipment for Buildings—Under this title the **Worthington Pump & Machinery Corporation**, 2 Park Ave., New York City, has issued Bulletin WP-1003. The equipment discussed includes steam and electrical pumps for heating systems, vacuum pumps, sump pumps, house pumps, pumps for swimming pools, pumps for elevators and lifts and for ventilating systems, and fuel oil pumps. Other subjects covered include wells, fire protection, cold water, oil and condensation meters, refrigeration and compressed air for buildings. There are numerous illustrations of different types of equipment and installations.

Premier Christmas Sales Helps—The publicity department of the **Electric Vacuum Cleaner Company, Inc.**, 1734 Ivanhoe Road, Cleveland, recently issued a new 28-page brochure, with the self-explantory title, "The Premier Line of Christmas Selling Helps." The brochure includes a description of the Premier Christmas campaign in national magazines, proofs of new newspaper advertisements prepared for use during the coming holiday buying season, Christmas window display material, a new Christmas broadside, and other new sales helps.

Collector Rail Supports—Bulletin No. 31-GA, issued by the **Delta-Star Electric Company**, 2400 Block, Fulton St., Chicago, describes a new line of 600-volt collector rail supports for cranes, ore bridges and industrial railroad service. It contains a table on ratio of steel rail to copper resistance. Copies will be sent upon request.

Hydraulic Society Standards—The fifth edition of the Standards of **The Hydraulic Society** has been published. The principal changes from the preceding edition are a revision of the extracts taken from the A.S.M.E. Test Code for centrifugal and rotary pumps and changes in materials recommended for the construction of special service pumps, in line with the latest accepted practice. The pamphlet contains 80 pages in size 8½ x 11 in., is profusely illustrated and is priced at 50 cents. Copies may be had upon application to the secretary, C. H. Rohrbach, 90 West St., New York City.

ELECTRICAL WEST Barometer of Industrial Activity in Western States

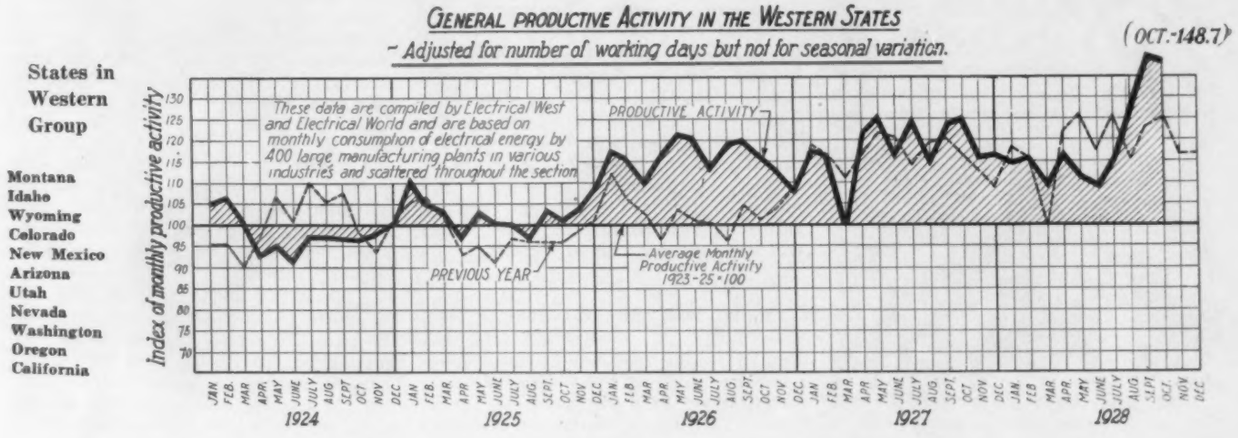
THAT the peak of manufacturing activity in the Western states for the year 1928 was reached in September is indicated by reports received on the consumption of electrical energy by the larger manufacturing plants of the section during the month of October. The rate of manufacturing operations during October, after corrections are made for the number of working days, was 1.4 per cent under September, but was 18.3 per cent over October last year. There seems to be little doubt but that the year as a whole will set a new record for production activity in the Western states. During the first ten months of the year the average rate of manufacturing operations was 3.6 per cent over that during the same period last year. This twelve-month rate of increase in manufacturing production is very close to the normal annual growth of American manufacture in general.

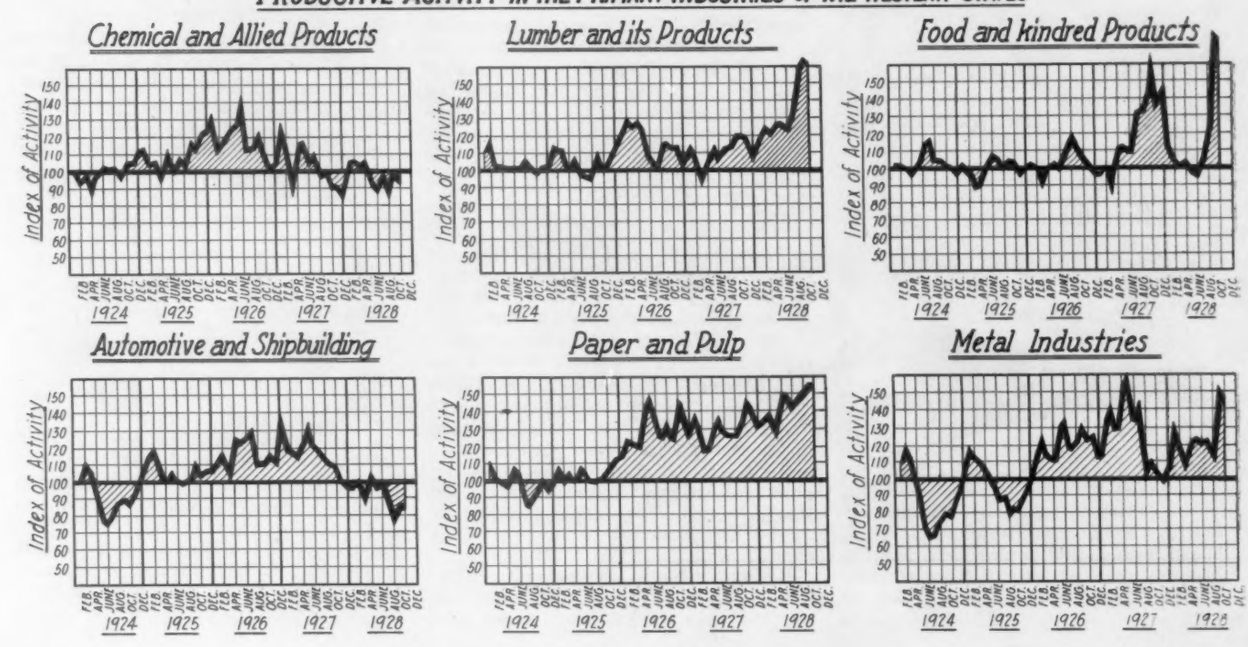
The lumber industry of the Western states continues to operate on a plane materially above that of last year. October rate of operations in these plants was about 0.7 per cent under September, but was about 33.2 per cent over October last year. The food and kindred products industrial group reports operations slightly above last year. October operations were about 2.0 per cent under September, but were 5.4 per cent over October last year. The average rate of activity in the food industry during the first ten months of the present year was 2.1 per cent over that during the same period in 1927.

Indexes of Manufacturing Activity in the Western States

(All figures adjusted for number of working days.)

	Oct. 1928	Sept. 1928	Oct. 1927	Av. for 1st 10 mo. 1928	Av. for 1st 10 mo. 1927
Chemicals and allied products	92.8	94.6	89.8	96.5	106.7
Food and kindred products	173.0	176.5	164.2	121.4	118.9
Lumber and its products	161.8	163.0	121.5	137.3	111.8
Metals group	148.7	152.6	104.3	128.2	132.1
Paper and pulp	156.8	155.7	147.4	146.4	132.5
Rubber and its products	183.5	160.5	119.0	154.2	
Shipbuilding	83.0	81.2	110.7	89.1	117.7
Stone, clay and glass	124.8	130.7	138.3	142.0	
All Western industry	148.7	150.8	125.7	123.5	119.2
All industry (U.S.)	132.0	134.5	119.9	122.6	115.8





The FOURSOME

A COLT PRODUCT

Color Page Advertisements in Leading Magazines

The New Colorful Four-Way Electrical Outlet

Green

Black

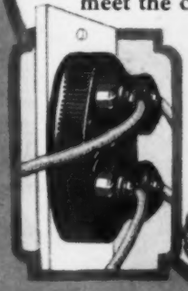
Walnut

Onyx

The Foursome jumped quickly into the first line of "Best Sellers"—because—

1. It caters to the modern vogue for color in the home.
2. It permits the use of up to four electrical appliances within current load limits.
3. It is the only multiple current outlet manufactured in colors and extensively advertised in colors.
4. Colorful "point-of-sale" displays and literature are furnished to Foursome dealers.

Prominent wholesalers everywhere predict immense sales and have stocked the Foursome for quick shipment. Order a big trial assortment from your jobber today to meet the certain demand for the Foursome.



Red

Mahogany

PRINTED IN U.S.A.

C.R.A.M. © 1928

THE FOURSOME WILL HELP TO SELL MORE ELECTRICAL APPLIANCES FOR YOU

Ask your jobber salesman or write to

COLT'S PATENT FIRE ARMS MFG. COMPANY, Hartford, Conn.

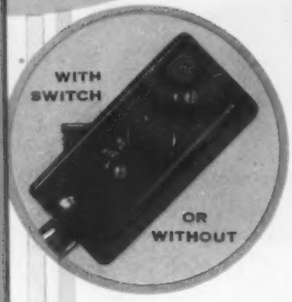
KOOL-PULL

Another COLT Product

THE CORD SET WITH THE RED PULL

Constructed of "Coltrock," on entirely new mechanical principles which eliminate 80 per cent of Cord Set troubles. Fits all standard appliances. Made with or without switch. Approved by Underwriters' Laboratories, Inc.

"TALKING POINTS" THAT CLINCH THE SALE!



Insist that Appliances you stock, come equipped with KOOL-PULL Cord Sets

A COLT PRODUCT

You'll quickly grasp the Big Idea—so will your customers who are tired of frayed cords, broken connections, short circuits and scorched fingers. The new Red Pull does it. What a seller! Colt never made a better product! Ride with this big success!

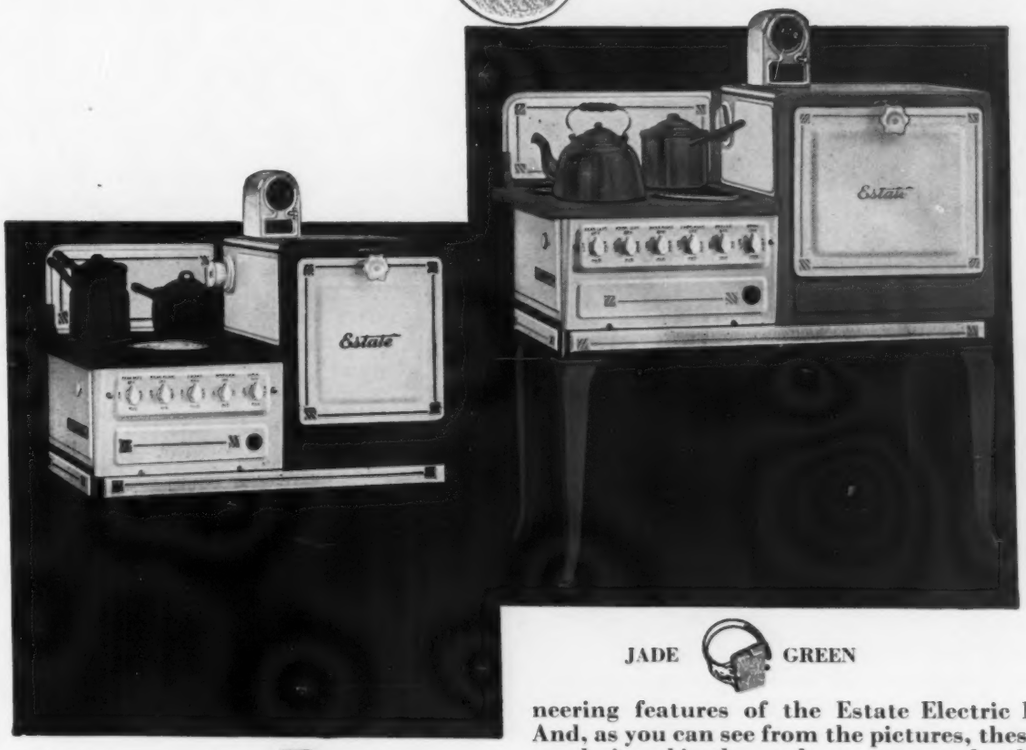
Your jobber has KOOL-PULL now. Get yours! National Advertising in Color Pages starts at once.

C.P.F.A.M.CO. © 1928

Ask the jobber salesman, or

COLT'S PATENT FIRE ARMS MFG. COMPANY, Hartford, Conn.

Estate Electric Ranges with—
BALANCED OVEN HEAT
automatically controlled



JADE GREEN

MANDARIN RED

EACH year sees some outstanding contributions to the art of electric cookery. And, this year, we are told, it is the new line of Estate Electric Ranges which is winning the enthusiastic approval of electrical men and domestic scientists everywhere.

Balanced oven heat—automatically controlled; single switch control; separate broiler control switch—these are just a few of the advanced engineering features of the Estate Electric Range.* And, as you can see from the pictures, these ranges are designed in the modern manner—for the kitchens of today. Simple, graceful—with not a nut, bolt or hinge in sight—good to look at—easy to keep clean. In all the standard finishes, of course, and in the very newest colors, too—Jade Green and Mandarin Red.

An Estate representative near you will welcome the opportunity to lay before you complete details of the new Estate line. He will also tell you about an unique plan which will help you to present these Estate Ranges to the women of your community. Set your time by mail or wire.

*The next page gives detailed technical information . . . please turn.

Estate ELECTRIC RANGES

. . . with automatically controlled,* balanced *oven heat

Made by* The Estate Stove Company, *Hamilton, Ohio

180 New Montgomery St.
San Francisco, Cal.

House Founded in 1845

Terminal Sales Building
Portland, Oregon

THE NEW ESTATE ELECTRIC RANGE

. . . *in technical terms*

BALANCED OVEN LOAD—All units in the Estate oven are balanced across the 220 volts on all three positions of the oven switch. This means just one-quarter of the voltage drop as compared with the same wattage on 110 volts—an advantage readily appreciated by all central station men.

BALANCED COOKING TOP LOAD—The cooking top units are balanced across the two sides of the 110/220 volt lines.

BROILER—The broiler is a separate coil, independent of the baking coils in the oven. It is located in the top of the oven, controlled by a separate switch, and has sufficient wattage to do a real job of broiling.

BALANCED OVEN HEAT—The wattage in the oven is so distributed between the upper and lower baking coils as to give a perfect balance of heat in the oven at all times. This has not been possible heretofore, where it has been necessary to use the upper baking coil as a broiler unit.

SINGLE SWITCH OVEN CONTROL—The baking coils of the oven are controlled by a single, three-heat switch. It is impossible for the housewife to unbalance the heat distribution in the oven.

GROUNDED NEUTRAL—The neutral wire is grounded to the frame of the range.

AUTOMATIC CONTROL—All Estate Electric Ranges may be had with automatic temperature control. Also, with timing device for full automatic control. All automatic devices can be removed easily or added at any time.

OVEN—The floor of the oven is one piece and the full size of the oven. There is no chance for food boiling over to come in contact with the lower oven unit. The oven floor is flush with the bottom of the oven door line, and is on line with the oven door when the door is open. No space is taken up by the oven unit in the oven, resulting in greater height to the working space inside the oven. The oven lining is finished in a mottled enamel on both sides, making the oven rust-proof. All corners of the oven are rounded. The oven is heavily insulated, the insulation being held in place by an inner wall which is independent of the outside panels. These outside panels can be removed and replaced without disturbing the insulation. The oven floors, oven ledges and all oven units are easily removable for cleaning or repairs.

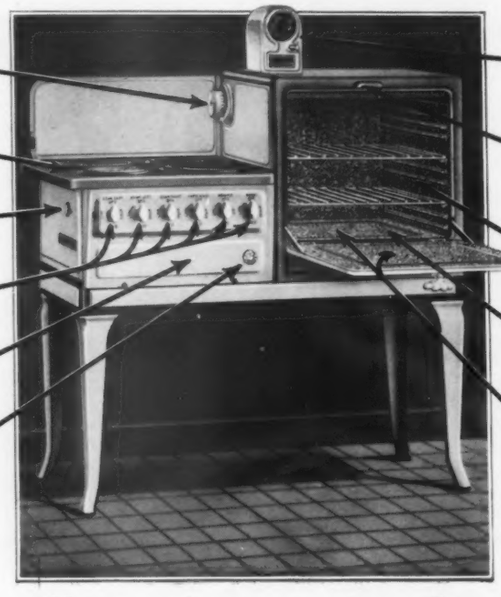
SWITCHES—All switches are of the reciprocating type.

APPLIANCE RECEPTACLE—An appliance receptacle is provided on the end of the range.

SURFACE UNITS—The ranges are regularly furnished with open-type units. Enclosed units will be furnished when ordered.

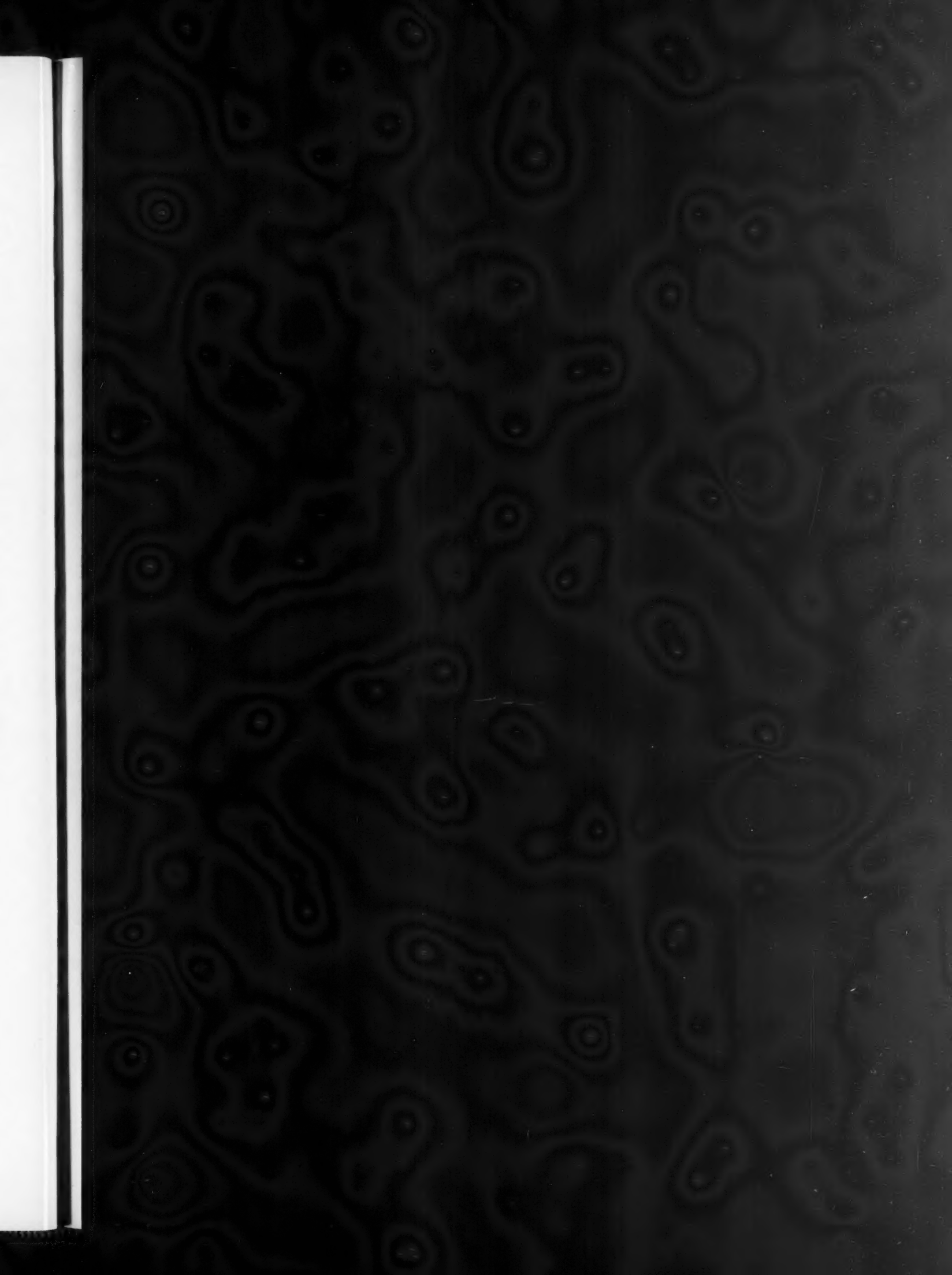
SERVICING—Every part of the range is easily accessible for servicing. By removing the switch panel, the fuses, all wiring to switches and relay for temperature control are easily accessible.

—**AND MANY OTHERS!**



1. ThermEstate Oven Heat Control.
2. One-piece, smooth cooking top.
3. Appliance receptacle.
4. Reciprocating indicating switches.
5. Switch panel, easily removed by releasing four bolts to reveal entire wiring system.
6. Pilot light to indicate when burners are in use.
7. Timing device for automatic control.
8. Removable oven top unit.
9. Removable oven ledges.
10. Removable oven bottom.
11. Oven bottom flush with door.

See full color illustrations on preceding page

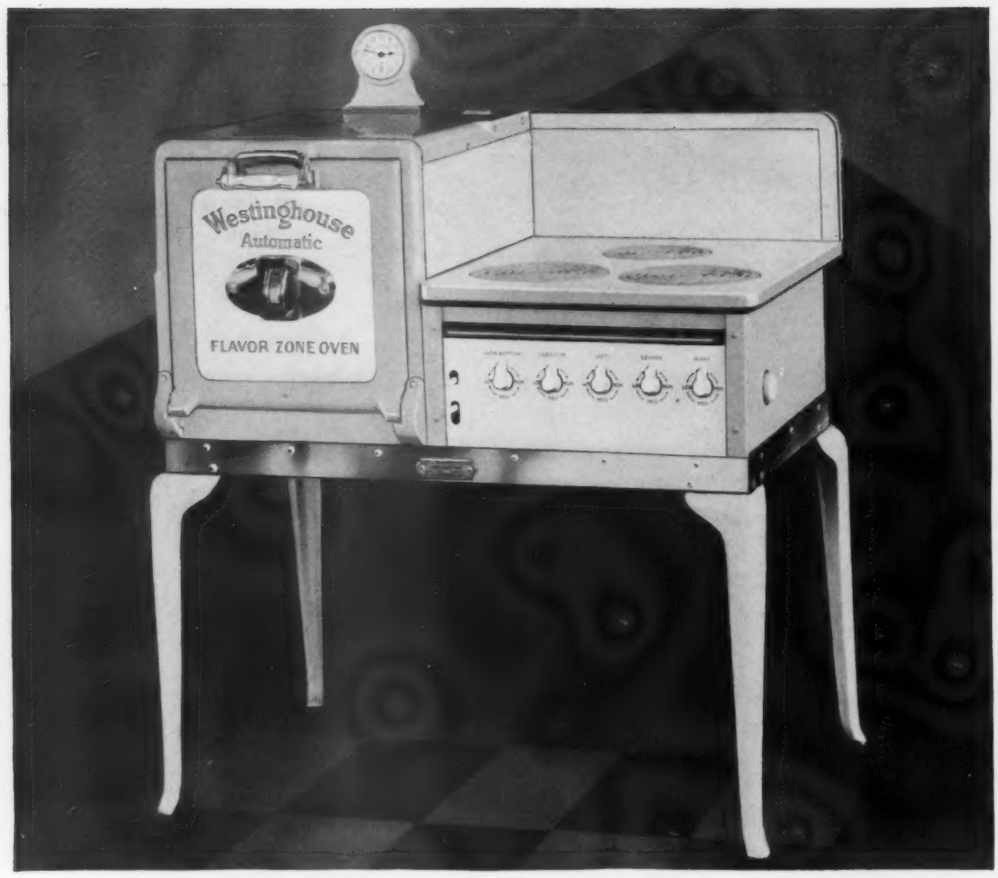


The
NEW NOTE OF
COLOR
IN KITCHENS
The modern woman has discovered that color makes the kitchen a far pleasanter place in which to work, so she's busy painting the walls in gay hues—hanging vivid curtains at the windows—purchasing pots and pans in riotous reds, yellows and greens. After years of monotonous, glistening white, she just can't get enough of color. It's for her that Westinghouse has added still another delightful color note to the kitchen harmony. The popular Junior Console Ranges may now be had in a choice of three lovely shades —Console Green, Ivory or Blue.

Westinghouse

strikes another new note in range selling . . .

Turn the page and see how much it will add to your PROFITS . .



Westinghouse *now offers the popular* JUNIOR CONSOLE RANGE *in three striking new colors . . . . .*

This range in Console Green, Console Blue or Console Ivory is as up-to-date in appearance as the "Flavor Zone" method is in cooking practice. And it appeals to the same women — the most progressive in your community — those who are interested in improving the art of home-making.

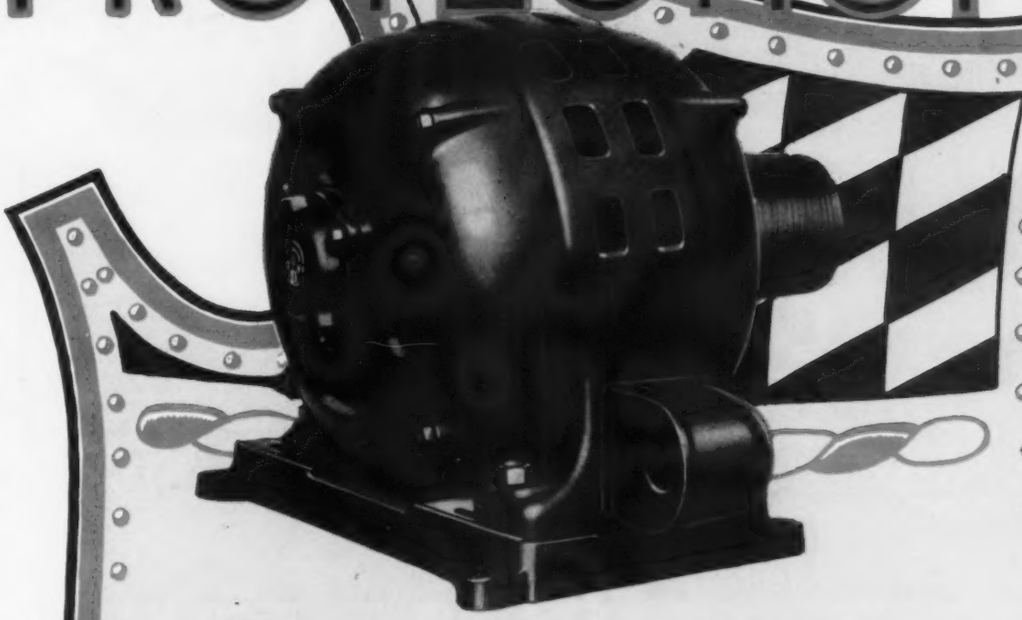
Console Green is delightfully cool and springlike — Console Blue is a soft, harmonious color — Console Ivory, a rich and slightly more conservative shade. Women who want something new, exclusive and attractive, are instinctively attracted by these lovely Console Colors.

In addition to color, this latest model has all the advantages that have made Westinghouse Junior Console Ranges so justly popular. It is amazingly compact — admirably adapted to the cooking requirements of a family of five or six — has the new oven door thermometer and all other features of the largest ranges.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
RANGE SECTION · MANSFIELD WORKS, MANSFIELD, OHIO

See the Junior Color Console for yourself in all three shades and you'll immediately understand its unusual display and selling possibilities. It is accurately pictured and clearly described in "THE NEW NOTE OF COLOR IN KITCHENS." Write for your copy today!

PROTECTION!



In a plant organized on a production line basis a single motor failure often entails a larger loss in dollars and cents than the motor is worth.

The plant executive's best protection from interrupted production due to motor failure lies in buying motors on the sole basis of the service that the manufacturer builds into them.

Fairbanks-Morse *could* offer you as an inducement to buy Fairbanks-Morse Motors a *name* which for reliability is unsurpassed by any in the electrical industry. But Fairbanks-Morse prefers that you investigate *comparatively* the *quality* of its product. This company asks that for your protection you look beyond the salesman's price book, that you look beyond the price tag. We ask *that you look at the motor!* We have confidence in our product and your ability to see *quality.*

POWER PUMPING AND WEIGHING EQUIPMENT

FAIRBANKS-MORSE MOTORS

Pioneer Manufacturers of ball bearing motors

FAIRBANKS-MORSE *Motors*

FAIRBANKS-MORSE *MOTORS*

A—Air inlet at free end of motor.
F—Specially designed fan which functions as an air cleaner.
D—Vent for foreign particles thrown out centrifugally by fan.
B—Clean air flows around winding shield and exhausts at opposite end of motor.
P—Plunger device for greasing ball bearing without removing fan guard or bearing arms.

Dustproof ball bearings. Self-sealing and requiring lubrication but once a year from a Fairbanks-Morse measured tube of grease lubricant.

Self-cleaning No piping! Totally-enclosed Self-Ventilating!

A standard motor with all the features that industry expects from Fairbanks-Morse—but now furnished in an all-enclosed, *self-ventilating type.* On those jobs that formerly required breather and vent piping to the outside you can now install the F-M Type "HAC" Motor with all the speed, convenience and economy of a standard open type motor application.

A specially designed fan pulls in air through the free end of the motor and expels all foreign particles. Clean air is then passed back through the ventilating spaces. Operating and maintenance men in every industry are acclaiming this motor as the ideal installation for dirty and dusty drives.

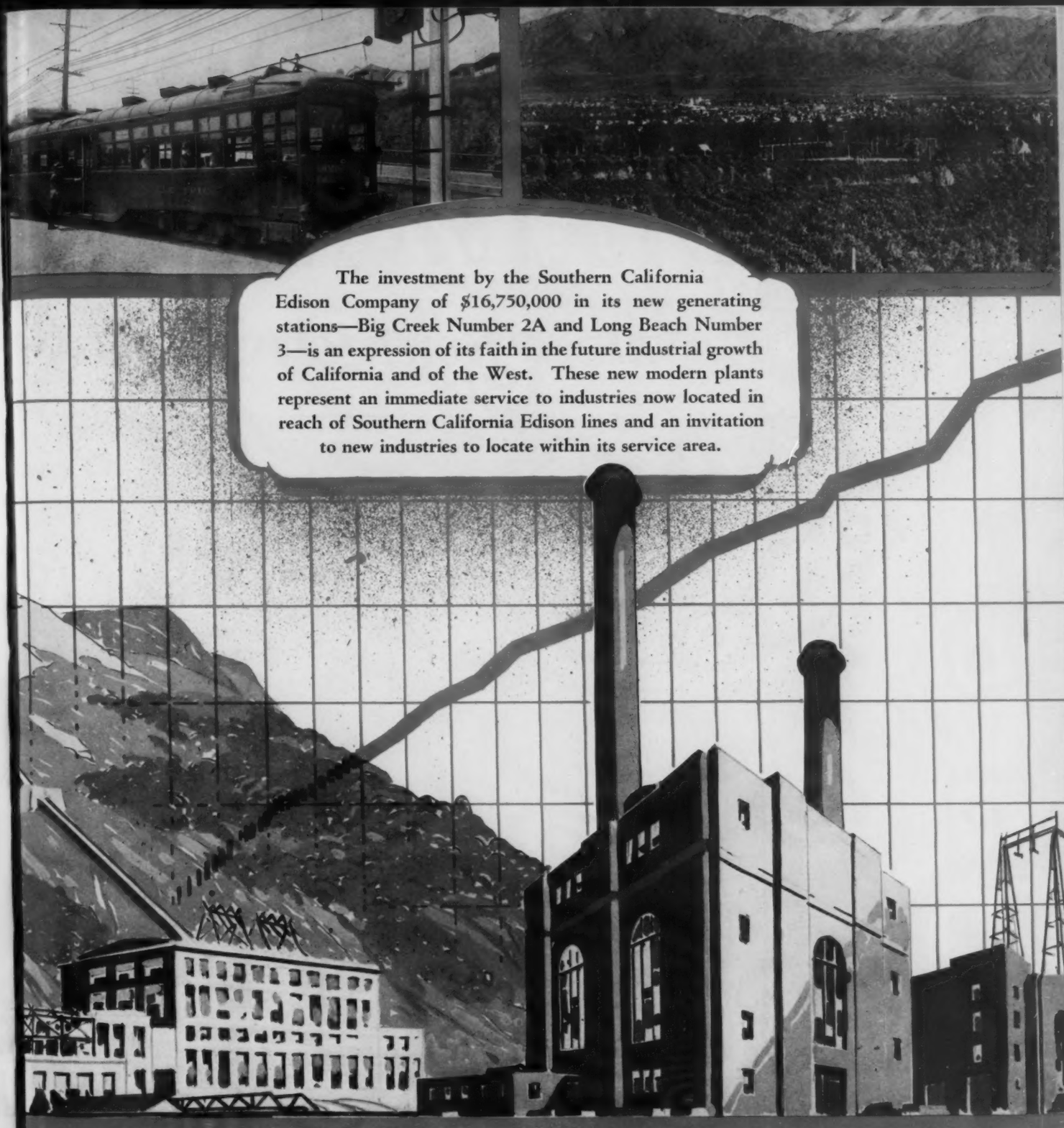
Before you purchase your next enclosed motors be sure to get full information on this important Fairbanks-Morse contribution to the power problems of industry.

FAIRBANKS, MORSE & CO., *Chicago*
Branches and Service Stations Covering Every State in the Union

POWER PUMPING AND WEIGHING EQUIPMENT

FAIRBANKS-MORSE
MOTORS

EA97.13

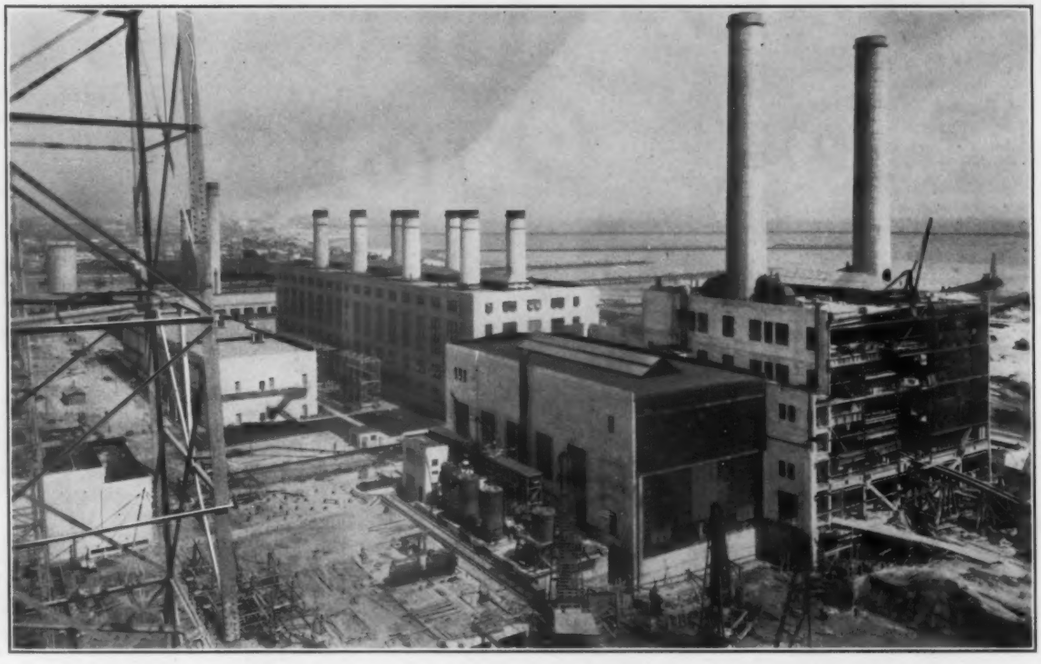


The investment by the Southern California Edison Company of $16,750,000 in its new generating stations—Big Creek Number 2A and Long Beach Number 3—is an expression of its faith in the future industrial growth of California and of the West. These new modern plants represent an immediate service to industries now located in reach of Southern California Edison lines and an invitation to new industries to locate within its service area.

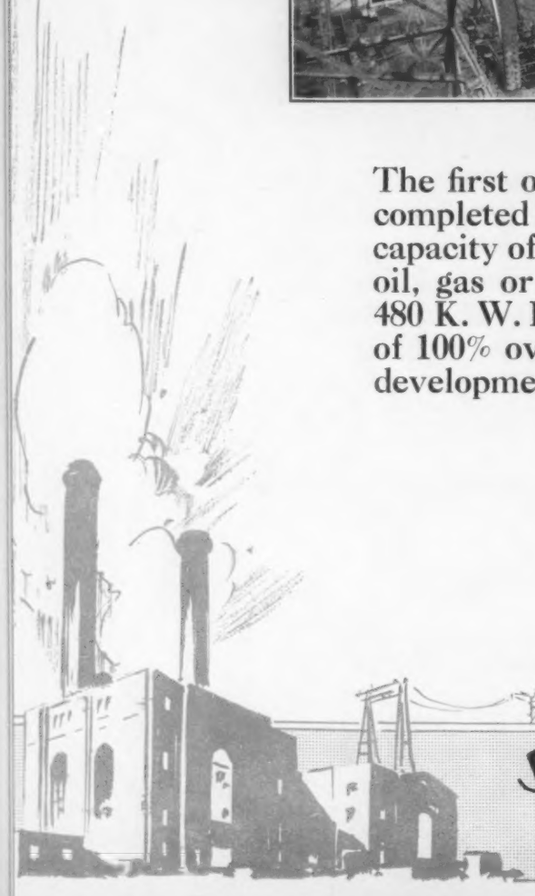
SOUTHERN CALIFORNIA EDISON COMPANY

237,000 Additio

to meet Southern Califor



The first of eight new 125,000 H. P. units, which when completed will give the Long Beach Steam Plant a capacity of 1,250,000 H. P. This unit is capable of using oil, gas or pulverized coal for fuel and is developing 480 K. W. H. per barrel of oil—an increase in efficiency of 100% over a period of sixteen years in steam power development.



Southern California

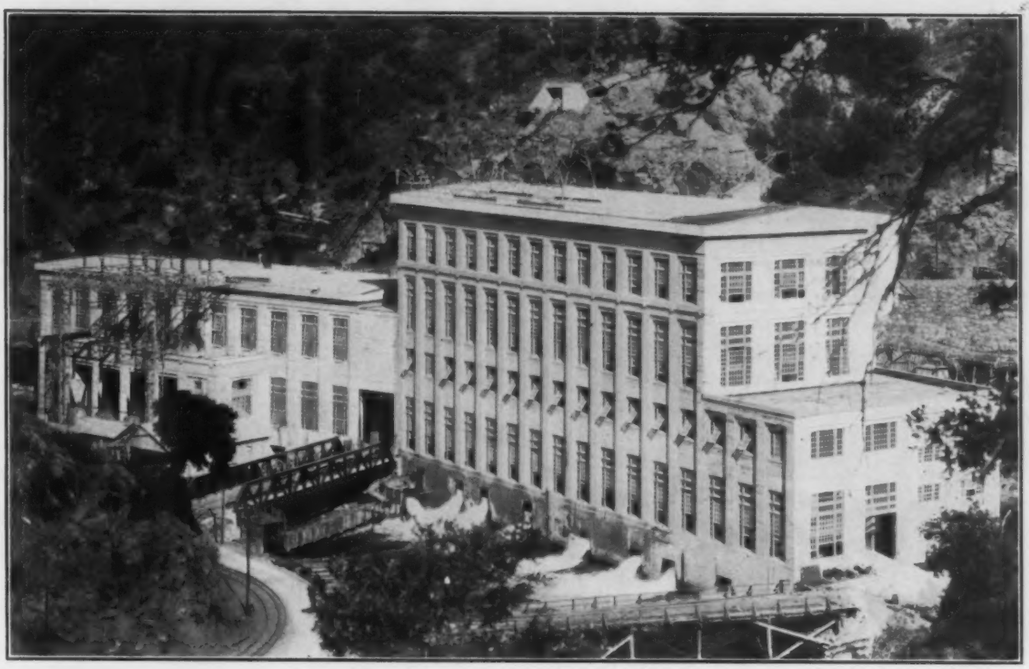
"Owned by Those

Southern California Edison Company

LONG BEACH

nal Horsepower

nia's Future Requirements



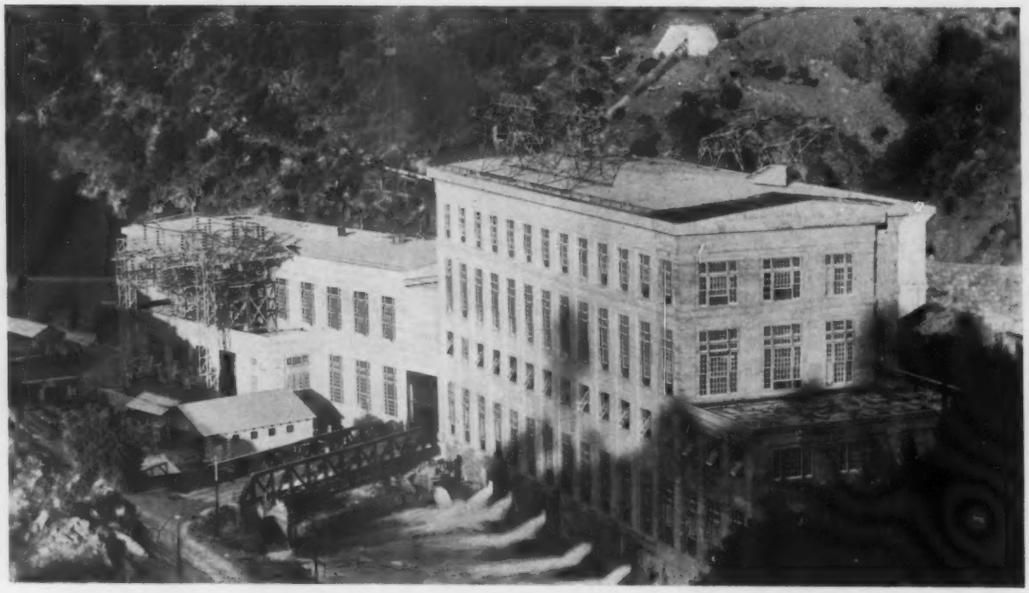
Power Houses No. 2 and 2-A of the Big Creek—San Joaquin River system are shown in this picture. Power House 2-A (on the left) adds 112,000 horsepower to the hydro-electric generating capacity of the Southern California Edison Company and brings the total capacity of the hydro-electric plants in the high Sierra up to 457,700 horsepower.

Edison Company

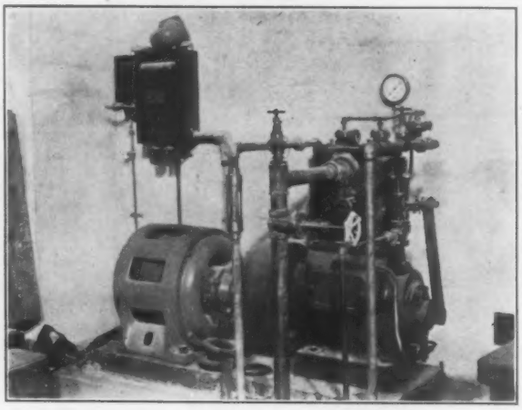
It Serves"

Southern California Edison Company

BIG CREEK



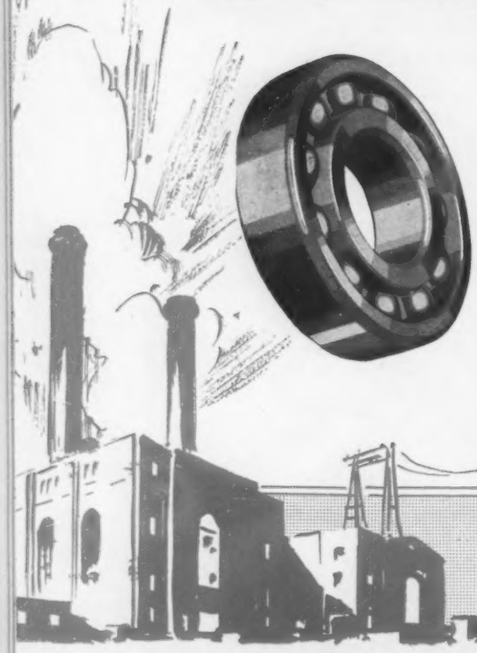
Cutting Maintenance Expense



¶ The Southern California Edison Company recognizes the advantages of ball bearings in electric motors.

¶ The air compressor in the Big Creek 2-A Power House is driven by a U. S. Motor equipped with New Departure Ball Bearings —the bearings that conserve power and cut maintenance cost—the bearings that have been the standard equipment of U. S. Motors for five years.

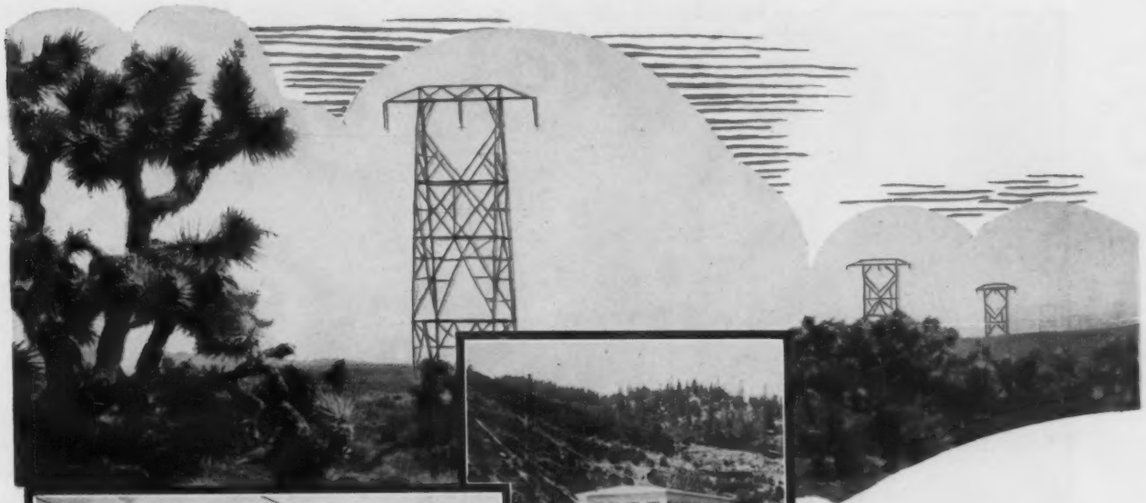
A booklet has been prepared telling why and how ball bearing electric motors save a high percentage of your motor maintenance expense. This booklet gladly sent on request.



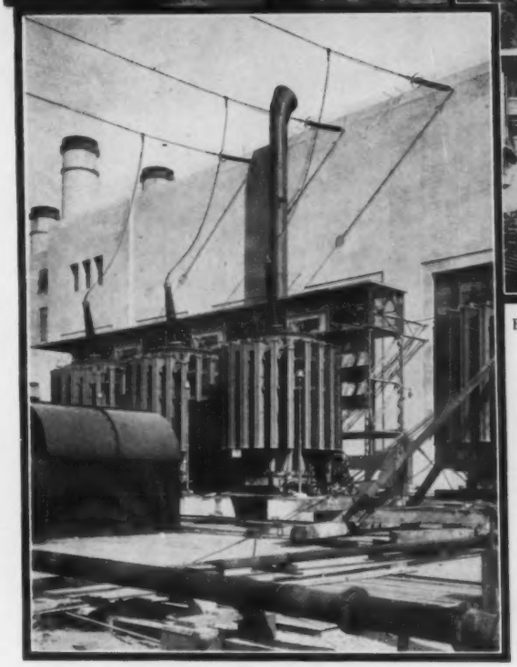
THE NEW DEPARTURE MANUFACTURING COMPANY
Bristol, Conn.
Chicago Detroit San Francisco

New Departure Quality Ball Bearings

Southern California Edison Company
LONG BEACH



Big Creek No. 2 hydro-electric station



Three 33,333 kv-a. Westinghouse single-phase 16.5 to 220-kv. shell-type power transformers at Long Beach No. 3 station.

Behind this 220 Kv. Transmission Line

running 230 miles between Los Angeles and Big Creek, are the

Westinghouse Power Transformers

which step up directly from the 16.5-kv. buses at Long Beach No. 3, and 11-kv. buses at the Big Creek Station.

The transformers are all of the Inertaire, self-cooled type, protected by Westinghouse 220-kv. oil circuit-breakers mounted outdoors at the foot of the take-off towers at both stations.

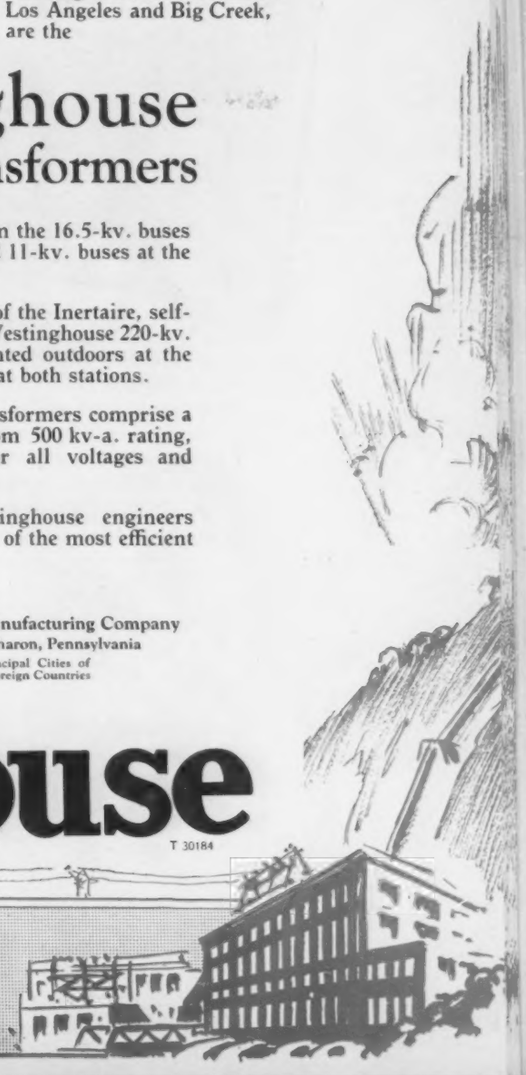
Westinghouse power transformers comprise a complete line ranging from 500 kv-a. rating, single or three-phase, for all voltages and frequencies.

Consultation with Westinghouse engineers will result in the selection of the most efficient capacity and type.

Westinghouse Electric & Manufacturing Company
Sharon Works Sharon, Pennsylvania
Sales Offices in all Principal Cities of the United States and Foreign Countries

Westinghouse

T 30184



Southern California Edison Company

BIG CREEK

Westinghouse Quick-Response Excitation

Quick-response excitation is also used for the operation of the 30,000 kv-a. frequency converter at the Rector Substation of the Southern California Edison Company. This frequency converter furnishes 60-cycle power for the San Joaquin Valley.

BIG Creek No. 2-A consists of two 45,000 kv-a. Westinghouse units, which are the world's largest horizontal water wheel generators. These generators were designed with exceptional stability characteristics, and the short-circuit ratio and reactance selected give the most economical combination of generators and transmission line.

As a further precaution to assure maximum service from the expensive 230-mile transmission line, Westinghouse quick-response excitation is used. This system employs the newly developed exciter-rheostatic regulator which varies the generator voltage through the medium of a motor-operated rheostat in the exciter field circuit. The regulator is used with a positive phase-sequence network, a distinctive Westinghouse feature, which assures proper regulator operation under all fault conditions.

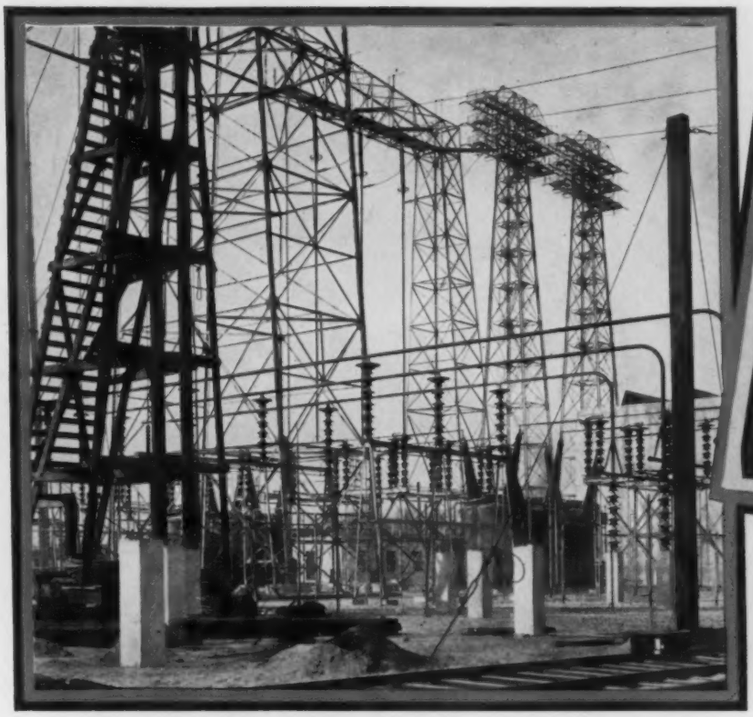
Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

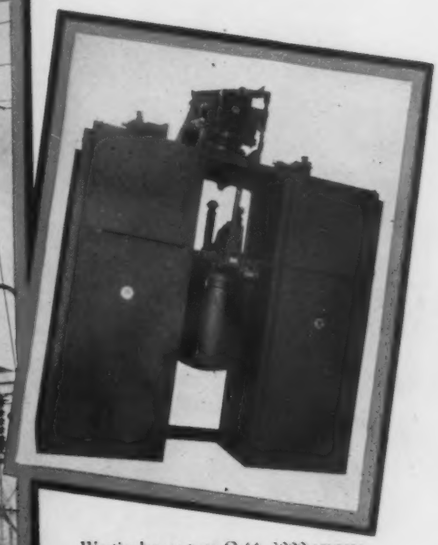
T 30185

Southern California Edison Company

LONG BEACH



Westinghouse 220 kv. breakers at base of take-off towers, Long Beach Station



Westinghouse type O-44, 3000-ampere, 25 kv., three pole, electrically operated, cell mounted, breakers. Each of the two 45,000-kv-a. generators is connected to the buses at Big Creek No. 2-A through two of these oil breakers to assure flexibility in operation.

Westinghouse Oil Circuit-Breakers

THE Southern California Edison Company has assured maximum protection to the generators in both the Long Beach and the Big Creek stations, and the transmission lines that tie these plants together, by installing Westinghouse oil circuit-breakers.

Reliability and low maintenance costs are outstanding features. On the low-voltage breakers parallel-path brushes assure adequate contact pressures under all conditions. On the high-voltage breakers high-speed contacts minimize oil deterioration and the severity of the duty on the breaker structure.

Westinghouse oil circuit-breakers are built in all required capacities and for all current and voltage conditions.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in all Principal Cities of the United States and Foreign Countries

Westinghouse

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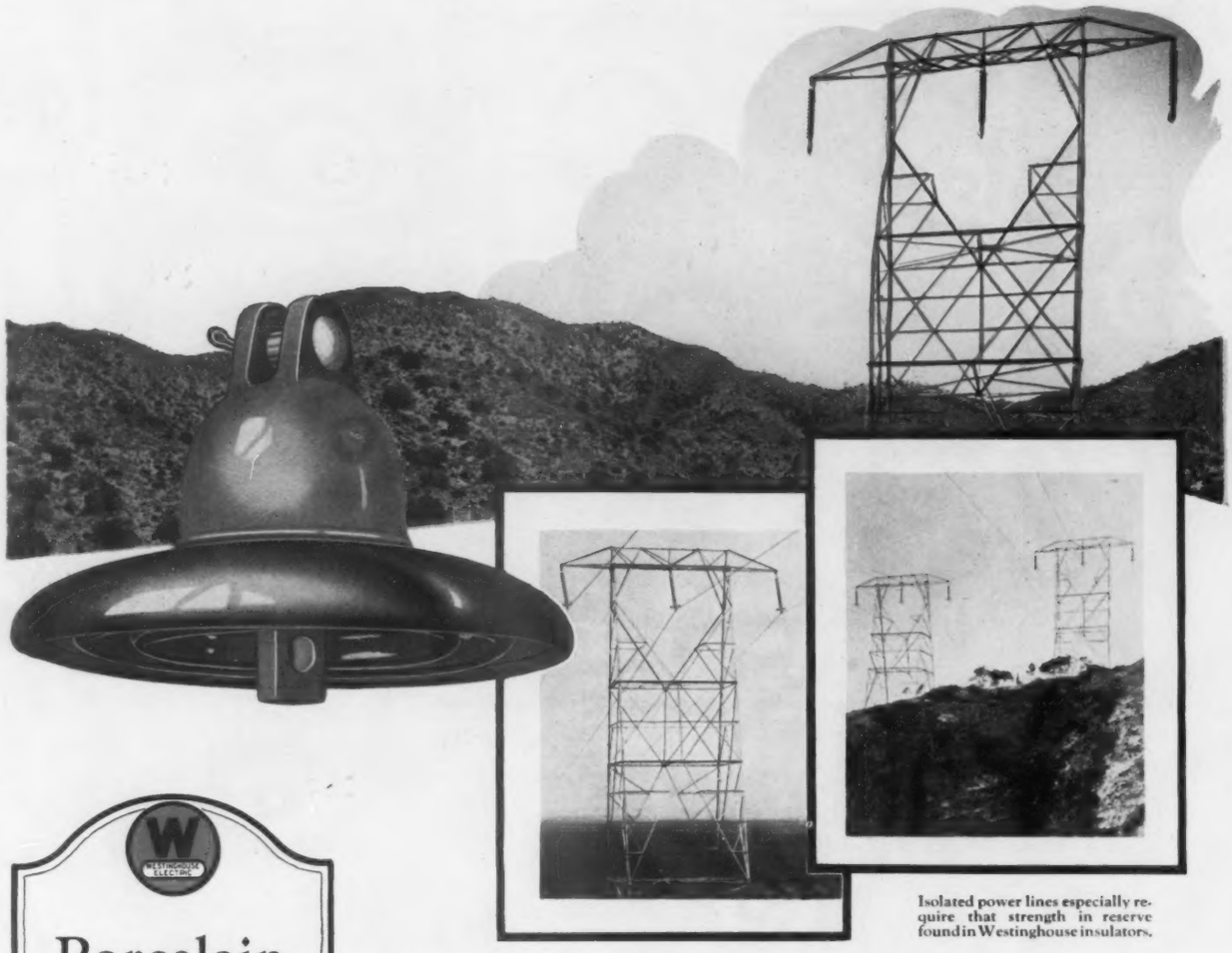
Southern California Edison Company

BIG CREEK



Isolated power lines especially require that strength in reserve found in Westinghouse insulators.

Porcelain
you can install *– and forget*

—because science—not tradition—governs the making of all Westinghouse porcelain and insulators.

—precision processes, at every stage, are the rule.

—never is anything taken for granted.

—even slight variations in materials are compensated for.

First the design—then the materials—then the method—and then, a vigilance that permits no compromise.

Westinghouse High Voltage Insulators

The reserve strength of Westinghouse insulators adds to the assurance of continuous service on this 220 kv. line. Westinghouse insulators are used because experience has proved them dependable. Southern California Edison first used Westinghouse insulators in 1921. The exceptional service from this initial installation paved the way for repeated re-orders.

Westinghouse supplies the Southern California Edison and all Pacific Coast customers from its porcelain works at Emeryville, California.

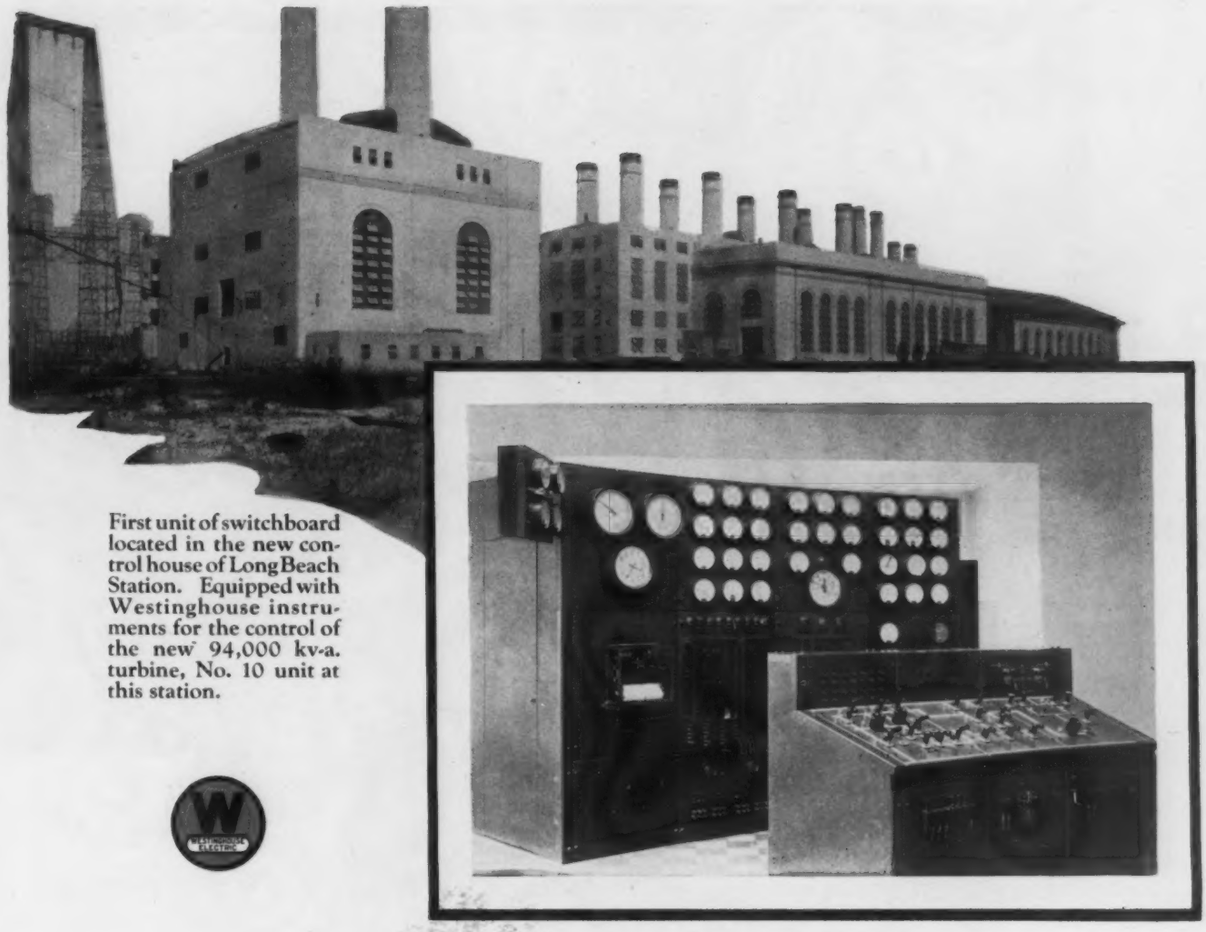
Westinghouse Electric & Manufacturing Company
Derry (Pa.) Works Emeryville (Calif.) Works
Sales Offices in all Principal Cities of the United States and Foreign Countries

Westinghouse

T 30187

Southern California Edison Company

LONG BEACH



First unit of switchboard located in the new control house of Long Beach Station. Equipped with Westinghouse instruments for the control of the new 94,000 kv-a. turbine, No. 10 unit at this station.

Westinghouse Switchboard Instruments

represent the highest development in modern instrument design and production.

Every required electrical measuring, metering and recording instrument is included in the line. High accuracy and long life are due to expert workmanship and quality materials. Every instrument is rigidly tested and calibrated.

Experienced Westinghouse switchboard engineers are available for consultation.

Westinghouse Electric & Manufacturing Company
Newark Works Newark, N. J.
Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

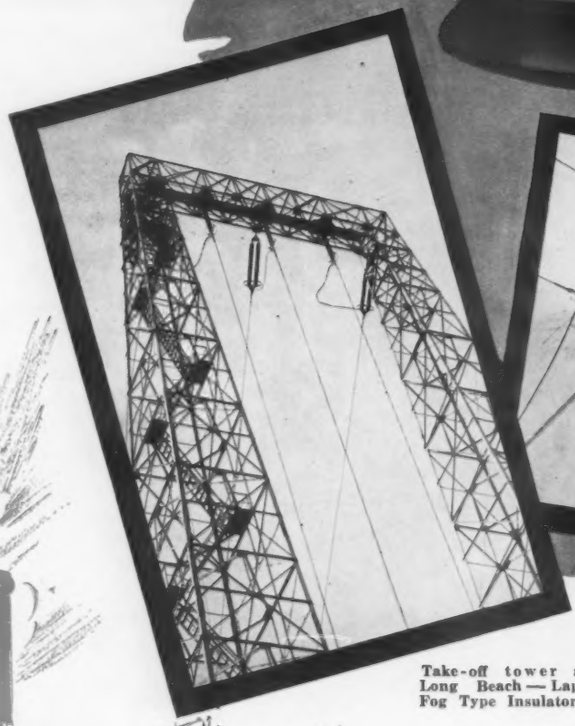
T 30188

Southern California Edison Company

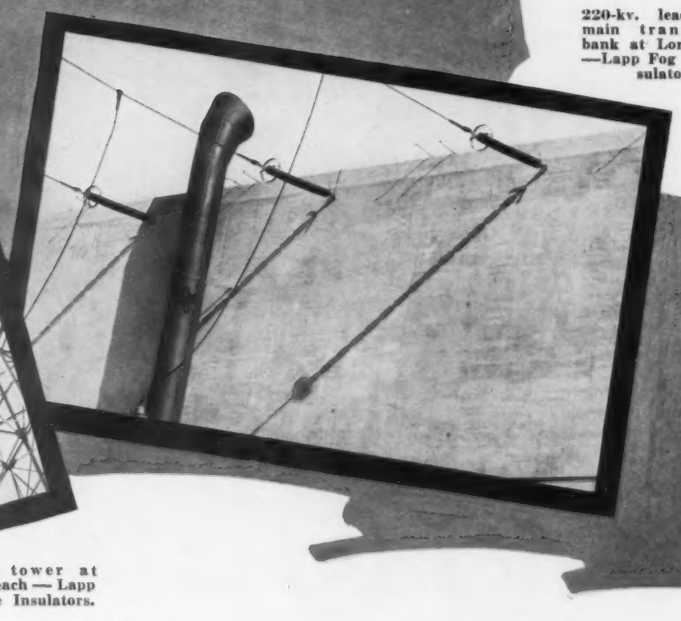
BIG CREEK

Side structure of take-off towers showing Lapp Fog Type Insulators.

and



Take-off tower at Long Beach — Lapp Fog Type Insulators.



220-kv. leads from main transformer bank at Long Beach —Lapp Fog Type Insulators.

Southern California Edison Company

LONG BEACH

LAPP *insulators of course!*

TESTED SAFETY -:- UTMOST STRENGTH

The use of Lapp Fog Type Insulators by the Southern California Edison Company at Big Creek 2-A is typical of the acceptance of Lapp insulators by many other of the largest utilities throughout the country.

Exhaustive Lapp tests pre-assure maximum safety.

Drop forged steel hardware gives an inherent super-strength.

Many others are holding outages to a minimum through the ability of Lapp's insulators to meet the hardest kind of service.

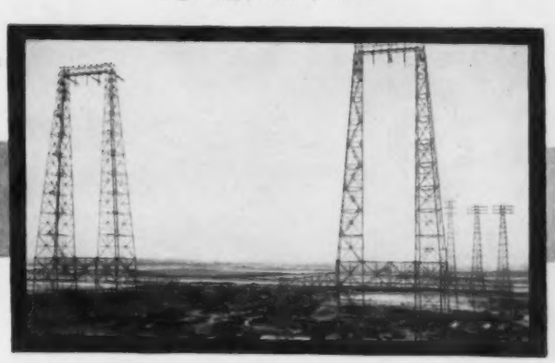
Call on our engineers to help you with those knotty insulator problems.

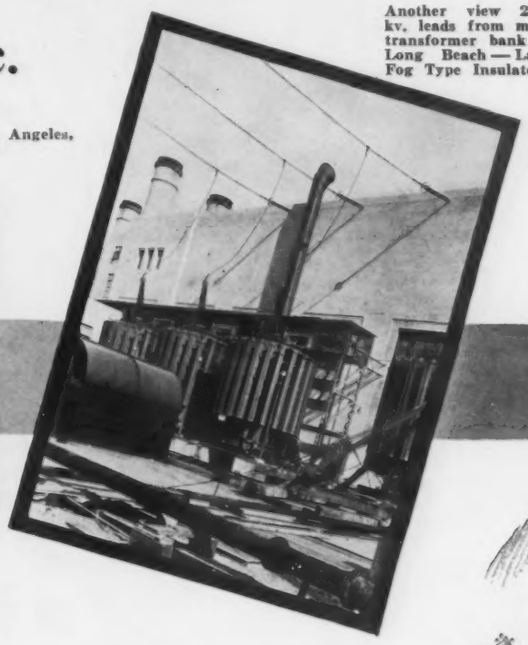
Lapp Insulator Co., Inc.

Le Roy, New York, U. S. A.

Pacific Coast Representatives—S. Herbert Lanyon, 210 Transportation Bldg., Los Angeles, Calif.; 509 New Call Bldg., San Francisco, Calif. W. R. Hendrey Co., Hoge Bldg., Seattle, Wash.

220-kv. risers at Long Beach —Lapp Fog Type Insulators



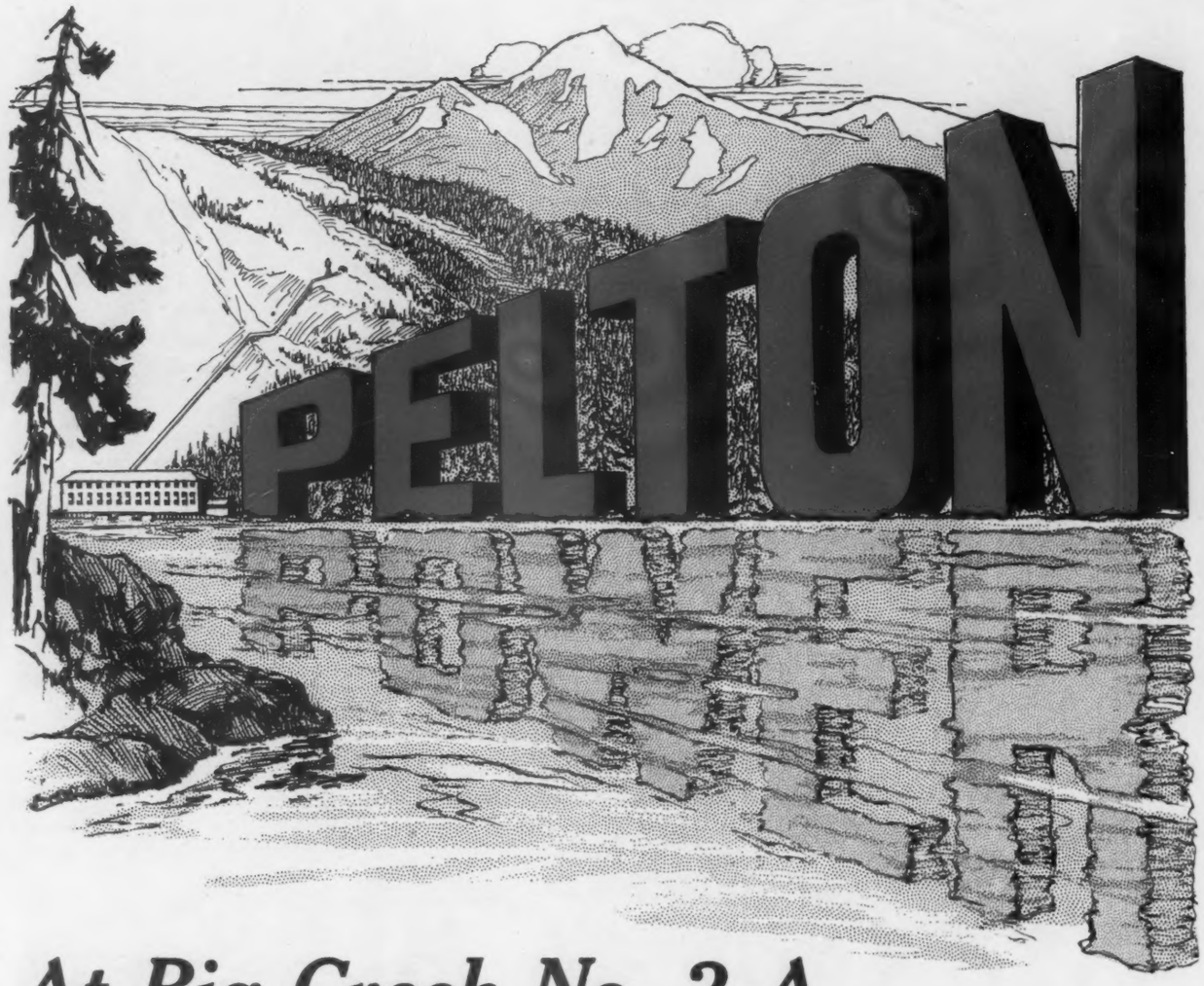


Another view 220-kv. leads from main transformer bank at Long Beach — Lapp Fog Type Insulators.

Lapp Insulators Do Not Fail!

Southern California Edison Company

BIG CREEK



At Big Creek No. 2-A

A 56,000 Hp. Pelton double overhung impulse turbine has been installed by the Southern California Edison Company and is now in commercial operation under 2290 ft. head. The unit has developed approximately 70,000 Hp. during test, which is a world record. Note these special features which have again conclusively proven—on a larger scale than ever before—the superiority of Pelton design.

WATER ECONOMIZING RELIEF NOZZLES, with full strength positive interlock to power nozzles, limit pressure rise to 6.5%.

STRAIGHT FLOW ENERGY DISSIPATORS successfully handle total discharge through relief nozzles despite space limitations.

POSITIVE HELICAL GEAR DRIVE for governor assures continuous operation and reduces the unit outage hazard.

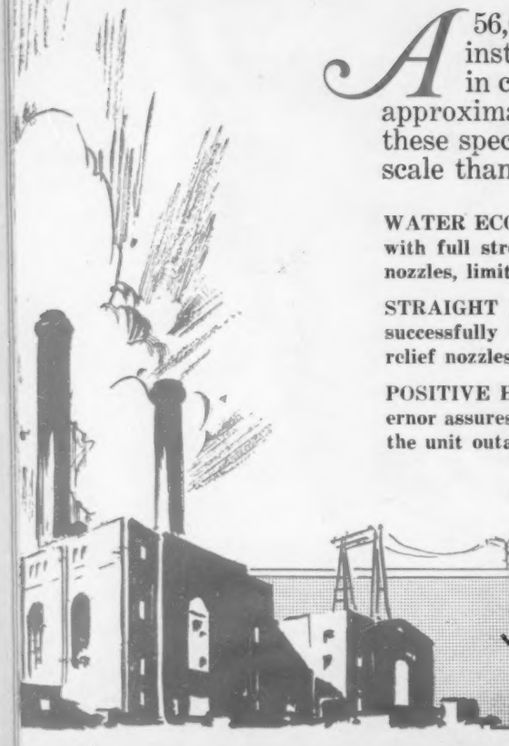
STRAIGHT FLOW NOZZLES eliminate losses due to change of direction of water flow.

DEMOUNTABLE BUCKET RING CONSTRUCTION reduces time out for runner maintenance.

REMOTE CONTROL and INDICATING INSTRUMENTS simplify and safeguard operation.

ALL PARTS of NOZZLE MECHANISM are in full view and easily accessible.

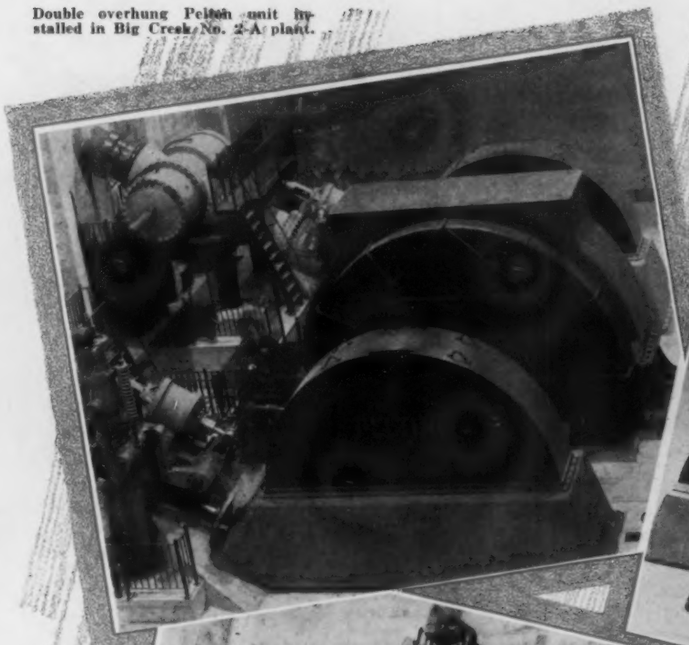
Pelton constructions used in this installation are fully covered by patents.



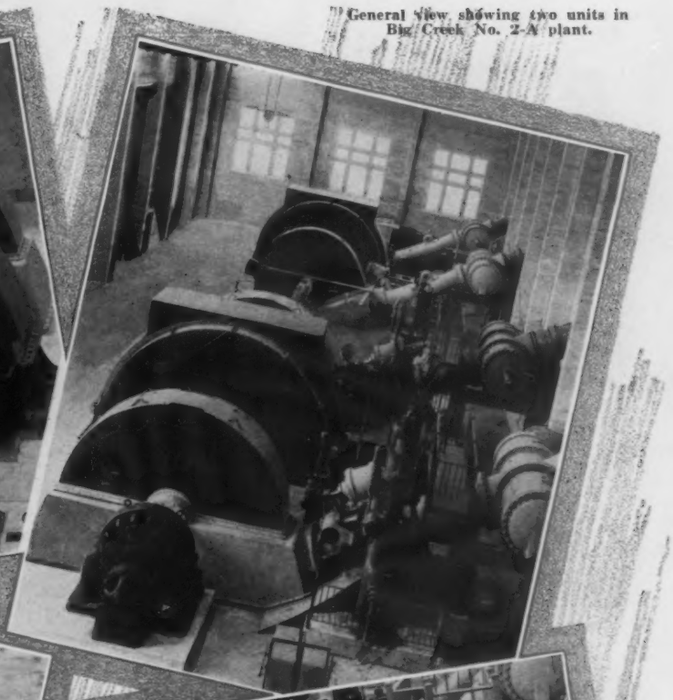
Southern California Edison Company

LONG BEACH

Double overhung Pelton unit installed in Big Creek No. 2-A plant.



General view showing two units in Big Creek No. 2-A plant.



Power nozzle and relief valve construction.

Detailed view of governor actuator and controlling mechanism.

THE PELTON WATER WHEEL COMPANY

Hydraulic Engineers

2985 Nineteenth St., SAN FRANCISCO — **100 Broadway, NEW YORK**

Associated Companies: I. P. Morris Corporation, Philadelphia, Pa.; Dominion Engineering Works, Ltd., Montreal.

Pacific Coast Representative for Larner Engineering Co., Philadelphia, Pa.; De La Vergne Machine Co., Philadelphia, Pa.

PELTON

Southern California Edison Company

BIG CREEK

WESTON RECTANGULAR SWITCHBOARD INSTRUMENTS *at* Long Beach Station

Weston Rectangular Instruments, in standard metal casings mounted flush with the board, have been selected as standard equipment for the main turbine room panels and all electric control boards at Long Beach Station of the Southern California Edison Company.

Weston Rectangulars are the modern instruments for the modern switchboard. Their space economy, wide scale openings, exceptionally low power consumption and low upkeep costs are characteristics which have established them in high favor with Central Station engineers the world over.

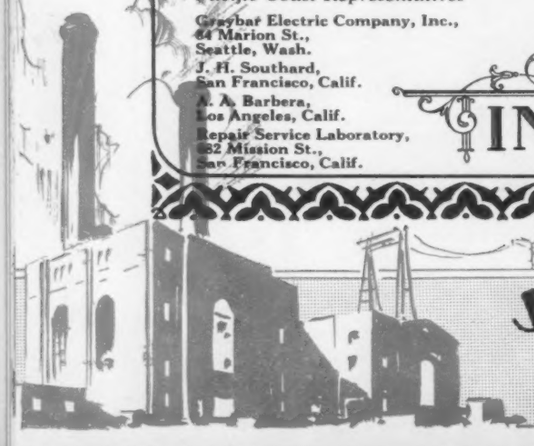
Weston Rectangulars are made as A. C. Voltmeters, Ammeters, Power Factor and Frequency Meters, Reactive Component Meters, Single and Polyphase Watt-meters, Triplex Ammeters and D. C. Voltmeters and Ammeters for Exciter Panels. All fully explained in Bulletin 1504.

Pacific Coast Representatives

Graybar Electric Company, Inc.,
64 Marion St.,
Seattle, Wash.
J. H. Southard,
San Francisco, Calif.
A. A. Barbera,
Los Angeles, Calif.
Repair Service Laboratory,
682 Mission St.,
San Francisco, Calif.

Weston
PIONEERS SINCE 1888
INSTRUMENTS

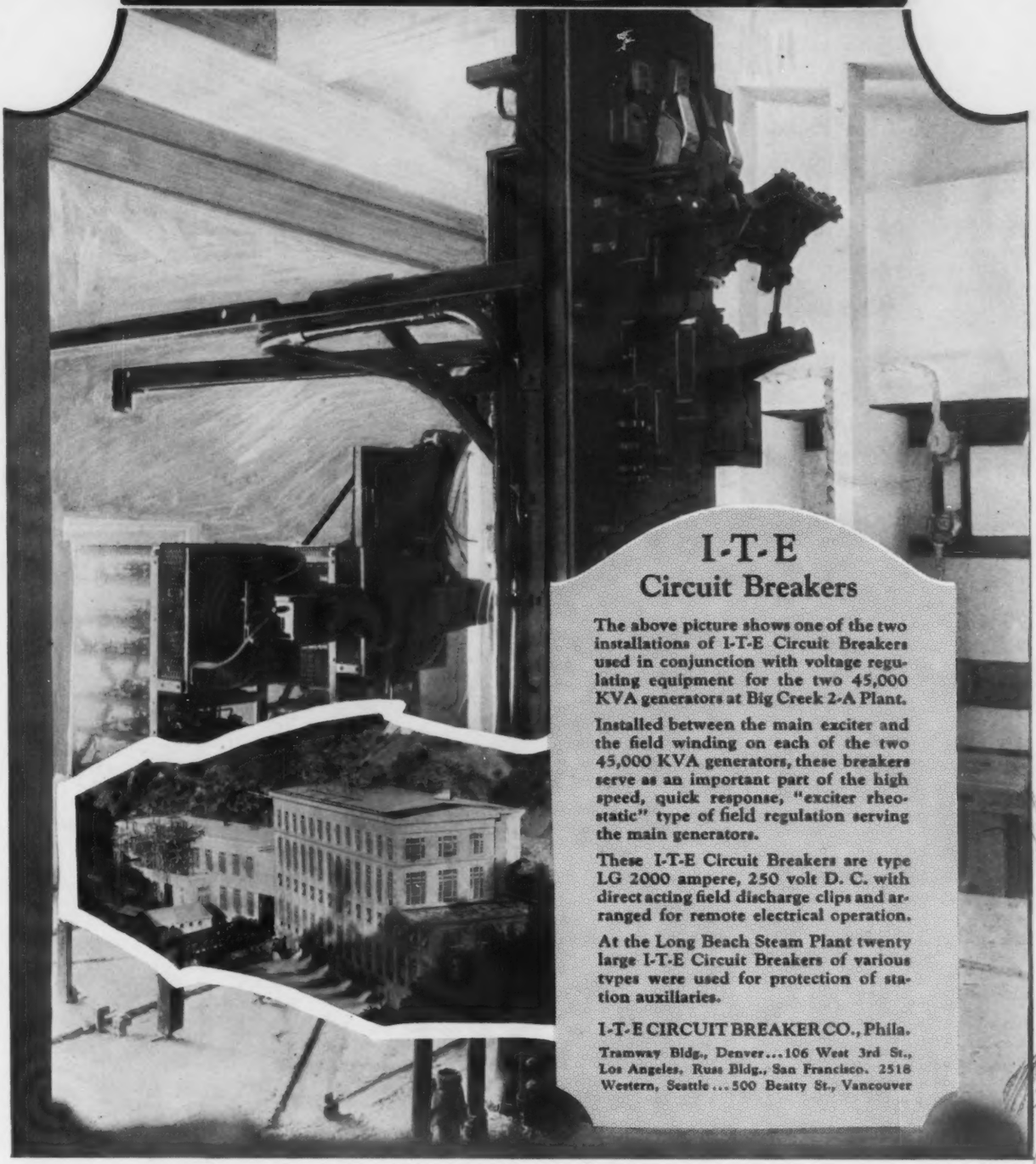
WESTON ELECTRICAL INSTRUMENT CORPORATION
577 Frelinghuysen Avenue
Newark, N. J.



Southern California Edison Company

LONG BEACH

I-T-E



I-T-E
Circuit Breakers

The above picture shows one of the two installations of I-T-E Circuit Breakers used in conjunction with voltage regulating equipment for the two 45,000 KVA generators at Big Creek 2-A Plant.

Installed between the main exciter and the field winding on each of the two 45,000 KVA generators, these breakers serve as an important part of the high speed, quick response, "exciter rheostatic" type of field regulation serving the main generators.

These I-T-E Circuit Breakers are type LG 2000 ampere, 250 volt D. C. with direct acting field discharge clips and arranged for remote electrical operation.

At the Long Beach Steam Plant twenty large I-T-E Circuit Breakers of various types were used for protection of station auxillaries.

I-T-E CIRCUIT BREAKER CO., Phila.

Tramway Bldg., Denver...106 West 3rd St., Los Angeles, Russ Bldg., San Francisco. 2518 Western, Seattle ...500 Beatty St., Vancouver

Southern California Edison Company

BIG CREEK

20,000 Square Feet Of Service and Safety

THE engineers of Long Beach No. 3 steam plant of the Southern California Edison Company specified 20,000 sq. ft. of Mitco Interlocked Steel Grating because of the permanent satisfaction and dependable service it has rendered in other large power stations.

Mitco has many outstanding advantages. It possesses unusual strength, coupled with permanent rigidity; permits maximum lighting and ventilation; has a non-slipping and non-clogging surface.

Power plant engineers not familiar with the advantages of Mitco Interlocked Steel Grating should send for our new bulletin. It also describes Mitco Shur-Site Stair Treads and Mitco Armorgrids.

HENDRICK MFG. CO.
Carbondale, Pa.

Los Angeles, Cal.
Continental Building Specialties Co.

San Francisco, Cal.
Badt-Falk Co.

Seattle, Wash.
F. T. Crowe

New York Office: 15 John Street
'Phone Cortlandt 2440

Pittsburgh Office:
981-B Union Trust Bldg.

Chicago Office: Ry. Exchange Bldg.
'Phone Wabash 5768

Atlanta, Ga. Baltimore, Md. Beaumont, Tex.
Boston, Mass. Charleston, S.C. Cleveland, O.
Detroit, Mich. Hazleton, Pa. Indianapolis, Ind
Montreal, Can. Philadelphia, Pa.
St. Paul, Minn. Tulsa, Okla.

Makers of Mitco Shur-Site Stair Treads, Mitco Armorgrids and Hendrick Perforated Metal Screens.

Mitco Interlocked Steel Grating
in the walkways at Long Beach plant No. 3

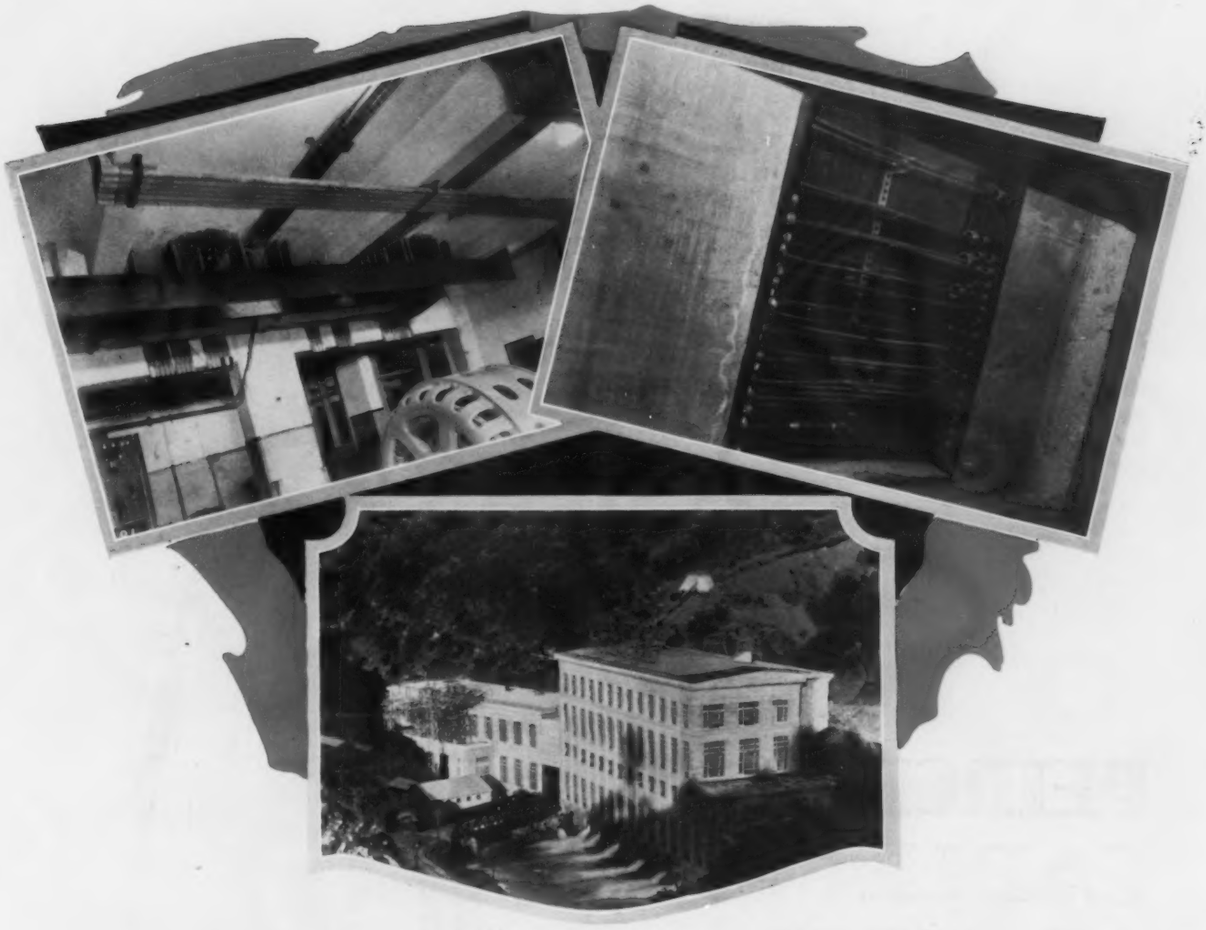
MITCO INTERLOCKED STEEL GRATING

The Grating With Every Advantage

Strength — Permanent Rigidity — Non-Slipping, Non-Clogging Surface — Light and Ventilation

Southern California Edison Company

LONG BEACH



and when it came to . . .

RIGID STEEL CONDUIT

THE Rigid Steel Conduit in the Big Creek 2-A Plant of the Southern California Edison Company bears the mark of the Central Tube Company—"Central White" having been installed.

It was selected because of the efficient service it has given in other big power projects.

This Conduit ranges in size from 1" to 4" and thousands of feet were used on the job.

In the upper illustration we show a small portion of "Central White" Conduit just after it was installed in Plant No. 2.

All of the controls, metering and other leads were brought from the No. 2-A Power House, an average of 100 yards, to this No. 2 Operating Room, from which the No. 2-A Plant will be controlled.

All of the control leads, even the lead covered cables, were drawn in Rigid Steel Conduit—see illustration at left.

This is one of the two main duct runs between Power House No. 2-A and switchboard of Plant No. 2. It gives a partial idea of the amount of Metal Conduit used on this job.

Central Rigid Steel Conduit renders service and we shall be pleased to tell you all about it.

Sales Representatives

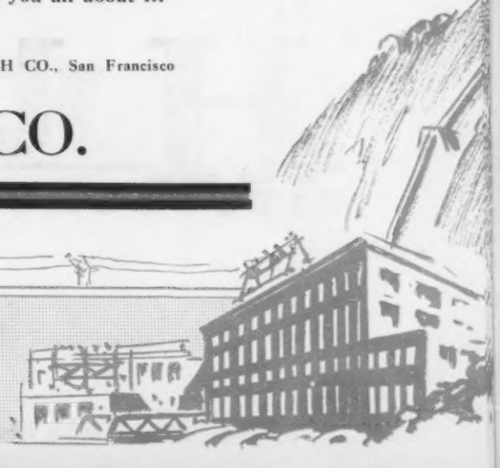
H. F. BOARDMAN, Inc., Los Angeles — C. R. BACH CO., San Francisco

CENTRAL TUBE CO.

PITTSBURGH

Southern California Edison Company

BIG CREEK



PEIRCE CABLE SUPPORTS at Big Creek 2-A

MANY hundred Peirce Cable Supports are used in the cable trenches, duct-line manholes and similar locations throughout the power house at Big Creek 2-A.

The photograph above shows one of the cable trenches with the cables on the right resting on the supports. On the left, the cables are in place ready for the supports.

Southern California Edison engineers know Hubbard material. If you are not now enjoying Hubbard insurance, there is no better time than the present to send for the 200-page Hubbard catalog. Get on the mailing list for the Hubbard Linebuilder.

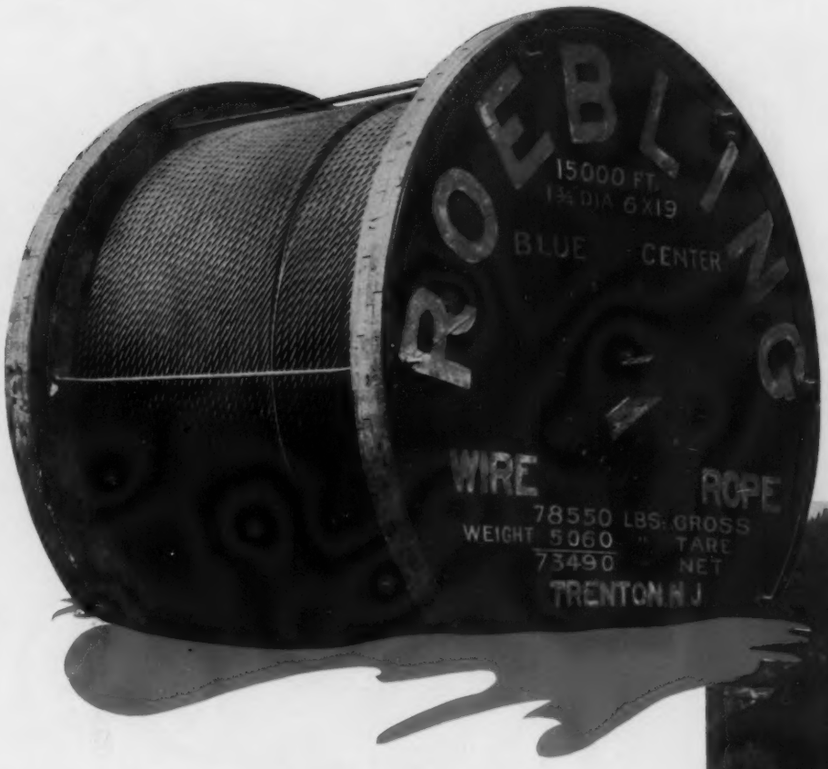
HUBBARD

Hubbard and COMPANY

PITTSBURGH • OAKLAND, CAL. • CHICAGO

Southern California Edison Company

LONG BEACH



How ROEBLING Played Its Part

A most important work at Big Creek 2-A was assigned to Roebling by the Southern California Edison Company. It was necessary to lower all material used on this job down the mountain side incline from the roadway above to the power house site. Water wheels, generators, transformers and other equipment were all safely handled by Roebling wire rope. The reel shown above contains 15,000 ft. of Roebling blue center wire rope of 1¾" diameter, weighing 73,490 lb. net. Blue center steel wire rope for special purposes where the work is extremely heavy or severe has no superior in point of strength and wearing ability.

Roebling products are applicable to all branches of the electrical field—supplying such equipment as follows:

For Power Transmission and Distribution

- Bare copper and copper strands
- River crossing strand, copper or steel
- Galvanized guy wire
- Weatherproof wire—double and triple braid
- Rubber covered wires
- Tree wire

For Power House and Substation

For Power House and Substation
- Switchboard wire and cables
- Apparatus control cables
- Annunciator wire and cables
- Armature leads and brush cable
- Wire rope for hoists, elevators, etc.
- Welding wire

For Electrical Appliances and Equipment

- Lamp cords
- Special portable cords
- Fixture wire
- Instrument wires and cables
- Telephone and telegraph wires and cables
- Police, fire alarm cables, braided or leaded

John A. Roebling's Sons Company of California

PACIFIC COAST OFFICES

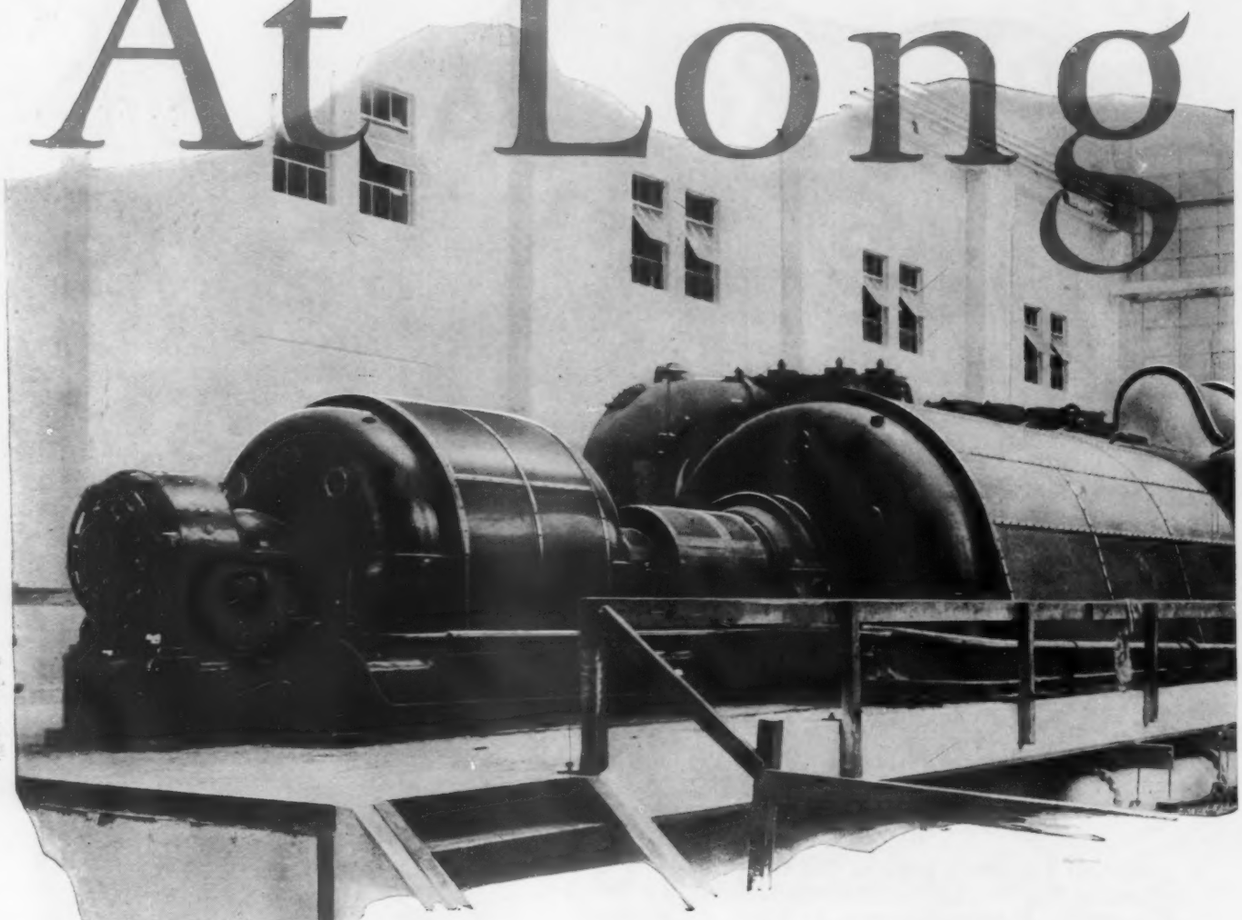
San Francisco, 624-646 Folsom St. — Los Angeles, 216 S. Alameda St. — Seattle, 900 First Ave. South — Portland, 14th and Lovejoy Sts.

Factories: Roebling, N. J., Trenton, N. J.

Southern California Edison Company

BIG CREEK

At Long



THE several projects of the Southern California Edison Company are notable examples of pioneering applications in the field of electric generation and transmission.

At Long Beach No. 3, a 94,000-kw., tandem-compound, General Electric turbine-generator, consisting of a 90,000-kw., 16,500-volt main generator—the largest single generator ever built—and a 4,000-kw. service generator, was recently placed in operation. A duplicate G-E turbine for the same station has been ordered.

Other features of this station are:

Surface-type generator air coolers for the closed ventilation system of the turbine-generator windings.

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Southern California Edison Company

LONG BEACH

Beach No 3

Two Type FH-209, 25-kv. oil circuit breakers for the main generator leads.

Two 500-hp., Type KT motors to drive the large condenser circulating water pumps.

Variable-speed, Type BTS, brush-shifting motors, and the necessary control panels for operating the forced-draft and induced-draft fans.

The Southern California Edison Company with the cooperation of G-E engineers is making history in central station progress.

172-26

ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES

Southern California Edison Company

BIG CREEK

(Top) Section of Vincent line.

(Center) A. C. S. R. being strung on Vincent line.

(Below) Big Creek line in Sierra foothills.

AC FROM BIG CREEK

The entire Vincent transmission line as well as the older Big Creek lines and the "Eagle-Bell" extensions are strung with A.C.S.R.

Practically every 220-kv. line in North America utilizes A.C.S.R. . . . . .

Its strength makes it desirable for lines across rough country where

ALUMINUM CABLE,

ALUMINUM OF AM

RIALTO BUILDING
SAN FRANCISCO

Southern California Edison Company

LONG BEACH

long spans must be strung with safety and economy.

Its lightness facilitates transportation and erection. . . .

Further facts as to why A.C.S.R. is chosen by the foremost transmission engineers everywhere—for high and low voltages—will be promptly supplied upon request. . . .

(Top) Another section of Vincent line.

(Center) 220-kv. tie line from plants 1 and 3.

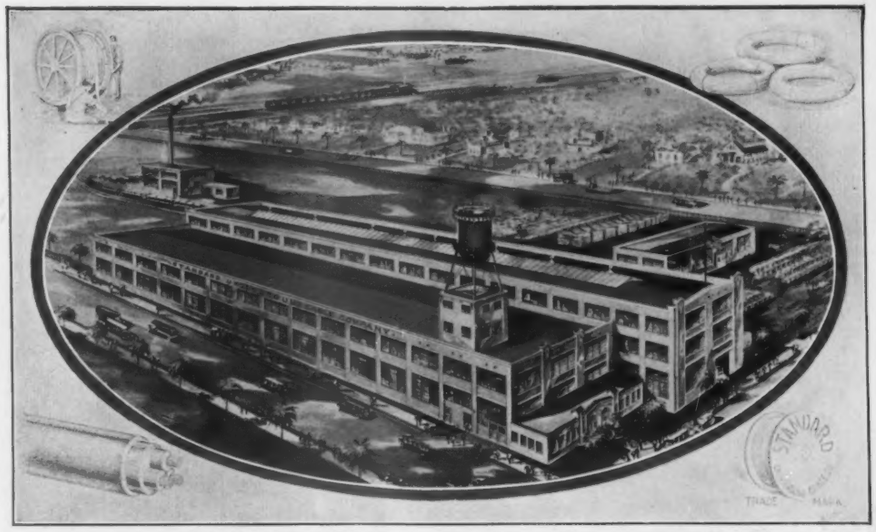
(Below) 220-kv. lines tying plants 2 and S.

STEEL REINFORCED

COMPANY
ERICA
2400 OLIVER BUILDING
PITTSBURGH, PA.

Southern California Edison Company

BIG CREEK



Southern California Edison uses

"STANDARD"

STANDARD Power Cables, Leaded Control Cables and Accessories were used in all Southern California Edison Company's Big Creek and Long Beach Plants. These cables were supplied from STANDARD'S Pacific Coast Factory at Emeryville, California, maintained solely for service to Pacific Coast Electric Cable Users.

Forty-five years successful manufacturing experience guarantees STANDARD Cable for all Services and Voltages.

Send your inquiries to our nearest sales offices.

STANDARD UNDERGROUND CABLE CO.

Division of General Cable Corporation

General Offices, Pittsburgh, Pa.

Pacific Coast Offices

San Francisco, Los Angeles, Seattle and Salt Lake City

Pacific Coast Factory—Emeryville, Calif.

Southern California Edison Company

LONG BEACH

PLANNED LIGHTING

When darkness envelopes the Big Creek No. 2-A Plant of the Southern California Edison Company, Holophane lighting illuminates the power house.

Darkness outside that you could cut with a knife.

Inside, brilliant and dependable Holophane illumination during the night hours.

1,000-watts, No. 691 Holophane Units, suspended from the roof trusses, are used exclusively. Holophane is also used in the adjoining power house No. 2 and miscellaneous other Holophane Units are used in and around power house No. 2-A.

Holophane Lighting Specifics are adaptable to every industrial need. Clear and searching illumination is assured wherever they are used.

May we send you further details and place our Illuminating Engineers at your service? Address HOLOPHANE COMPANY, INC., 74 New Montgomery St., San Francisco.

H O L O P H A N E

NEW YORK • SAN FRANCISCO • CHICAGO • MILWAUKEE • TORONTO

Southern California Edison Company

LONG BEACH

THE BABCOCK & WILCOX CO.

WATER TUBE BOILERS

NEW YORK

CHAS. C. MOORE, *Pacific Coast Manager*

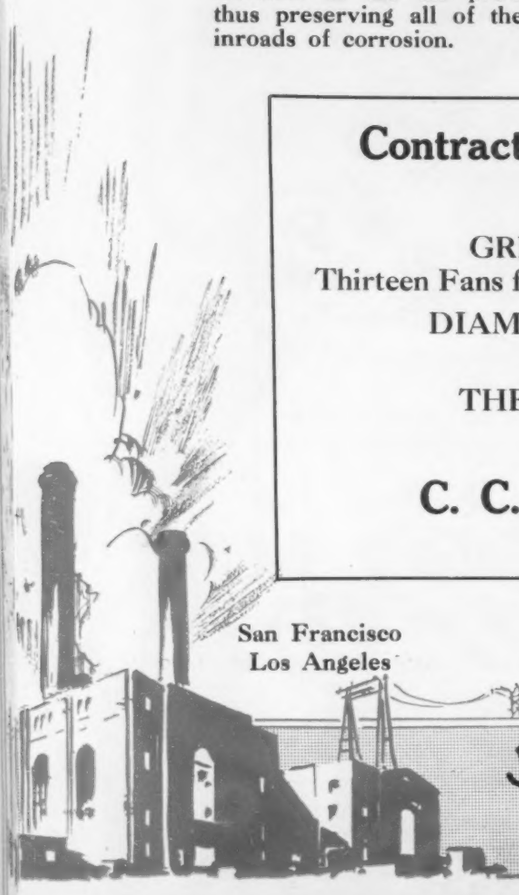
BABCOCK & WILCOX
BOILERS
POWER HOUSE TYPE

Three of these boilers of 3,460 H.P. each supply steam for the Number 3 Edison Station.

APEXIOR
REG. U.S. PAT. OFF.

Protects These Boilers

Apexior Number 1 is the coating applied to the internal surfaces of these boilers, including their tubes and the tubes of the water walls. The Apexior Number 3 was applied to the interior surfaces of the air pre-heater tubes, thus preserving all of these from the inroads of corrosion.



Contractors For Other Plant Equipment
Edison No. 3 Station

GREEN FUEL ECONOMIZER CO.
Thirteen Fans for Induced and Forced Draft and other purposes

DIAMOND POWER SPECIALTY CORP.
Valv-In-Head Soot Blowers

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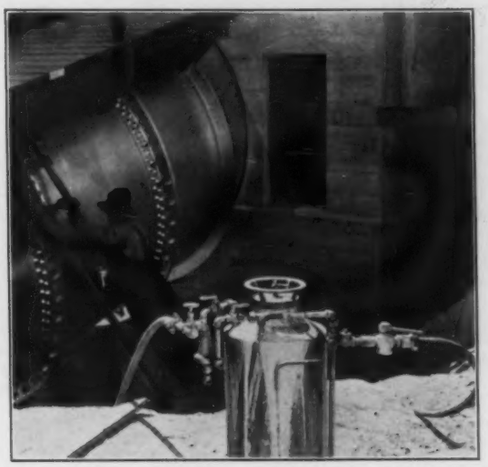
BIG CREEK

DUNN MECHANICAL PAINTING MACHINES



Used exclusively on the

Big Creek 2-A Job

Southern California Edison Co.

A handy SINGLE HOSE system, that ignores height or distance. It provides CONSTANT AUTOMATIC MIXING of the paint and sprays it on without layers or runs. You are sure of a smooth and thorough painting job if your men use DUNN MECHANICAL PAINTING MACHINES.

And the big outstanding feature of the DUNN is its VERSATILITY. While it is supreme in spraying light aluminum paint—it will likewise spray the heaviest coatings such as emulsified asphalts, highly viscous tar paints, thirty pound red lead, etc., WITHOUT THINNING.

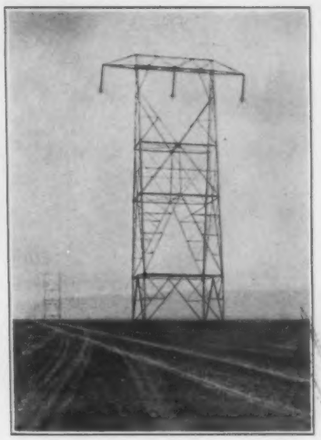
IN CENTRAL STATION WORK

SCAFFOLDING ELIMINATED, through the use of the DUNN 6 to 12 ft. EXTENSION NOZZLE. Weighs only 2 lb. and is easily handled by the operator on elevated surfaces.

IN TRANSMISSION LINE WORK

Run the DUNN single hose as high as you wish, with the machine standing on the ground. On special jobs operators have worked as far as 500 ft. away from the machine.

The patented DUNN ATOMIZER or CARBURETER accomplishes atomization of the paint at the tank, instead of the usual break-up in the atmosphere at the nozzle. This means one hose instead of two and ELIMINATES FOG.



Write us for catalog and advice concerning your particular jobs.

FOR SPEED AND UNIFORM COVERAGE IN PAINTING—SPECIFY "DUNN"

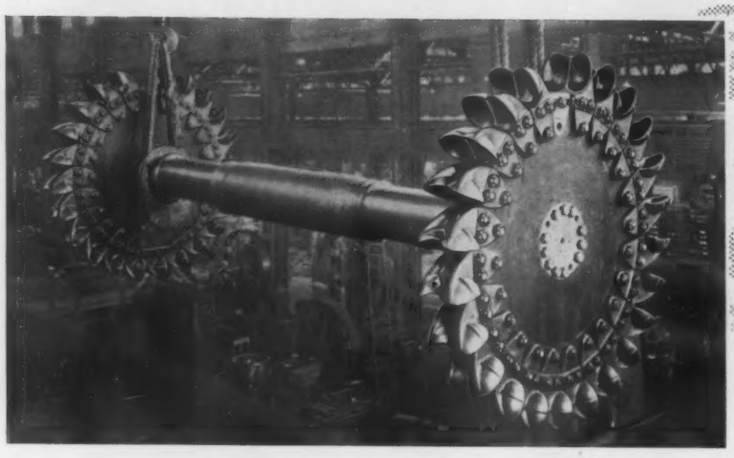
Dunn Painting Machine Corporation

General Office: 48 Front Street, New York, N. Y.

Southern California Edison Company

BIG CREEK

56,000h.p.ALLIS-CHALMERS

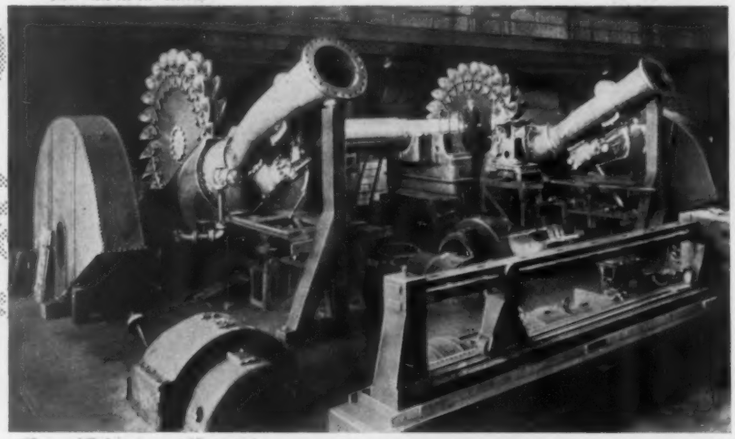


The rotating element of the 56,000 hp. Impulse Wheels, during erection in the shop. A 235,000 lb. lift.

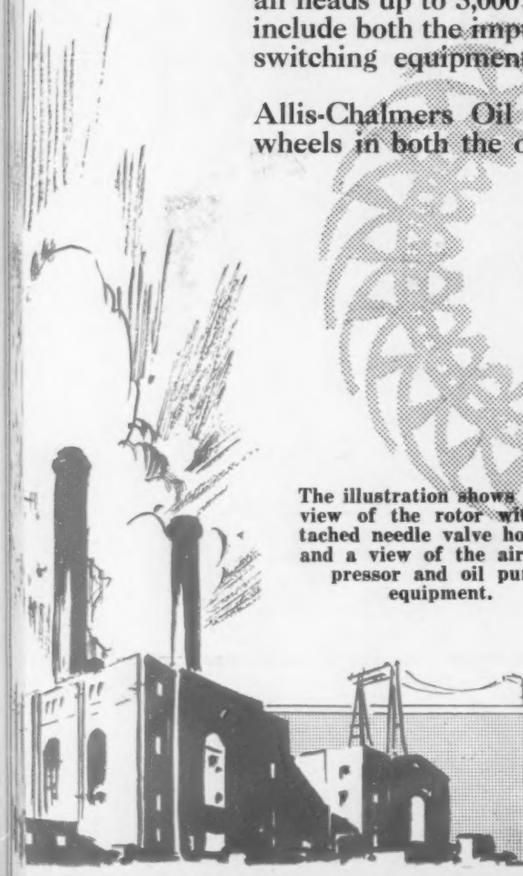
The new extension to Big Creek Hydro-Electric Station of the Southern California Edison Company is equipped with a 56,000 hp. Allis-Chalmers Hydraulic Impulse Turbine direct-connected to a 45,000 kva. water wheel generator. The unit is designed to operate normally under a head of 2200 ft. at 250 r.p.m. Views show relative disposition of wheels, nozzles, shaft and bearings with caps removed.

Allis-Chalmers Hydro-Electric Units are built vertical and horizontal for all heads up to 5,000 ft. and in rated capacities up to 85,000 kva. The designs include both the impulse and the reaction types, with complete governing and switching equipment. Over 4,000,000 hp. are in successful operation.

Allis-Chalmers Oil Pressure Governors control the operation of water wheels in both the old and the new parts of this station.



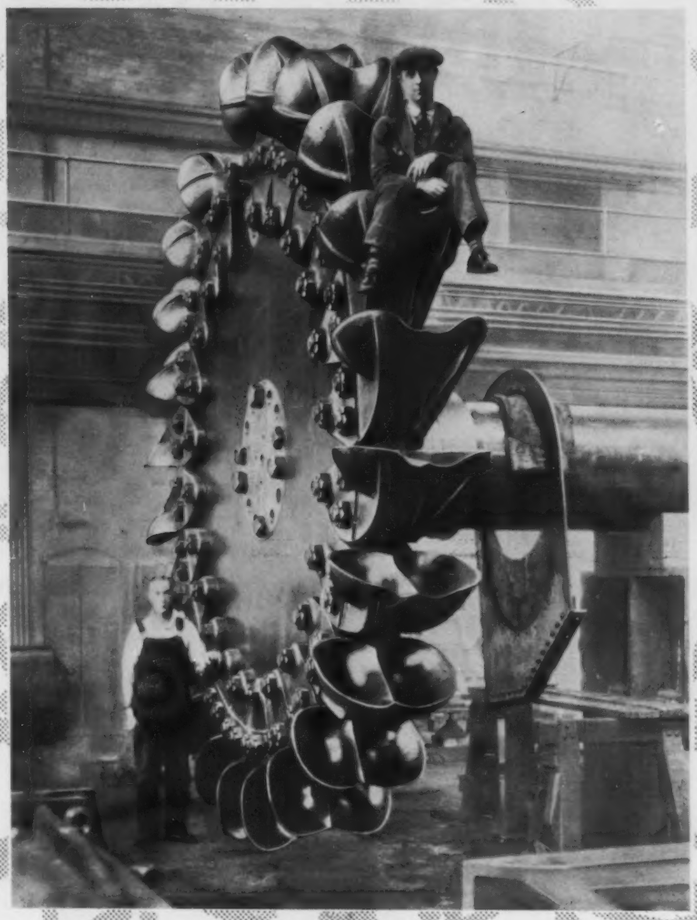
The illustration shows a side view of the rotor with attached needle valve housing, and a view of the air compressor and oil pump equipment.



Southern California Edison Company

LONG BEACH

Impulse Wheel Unit for Big Creek 2A



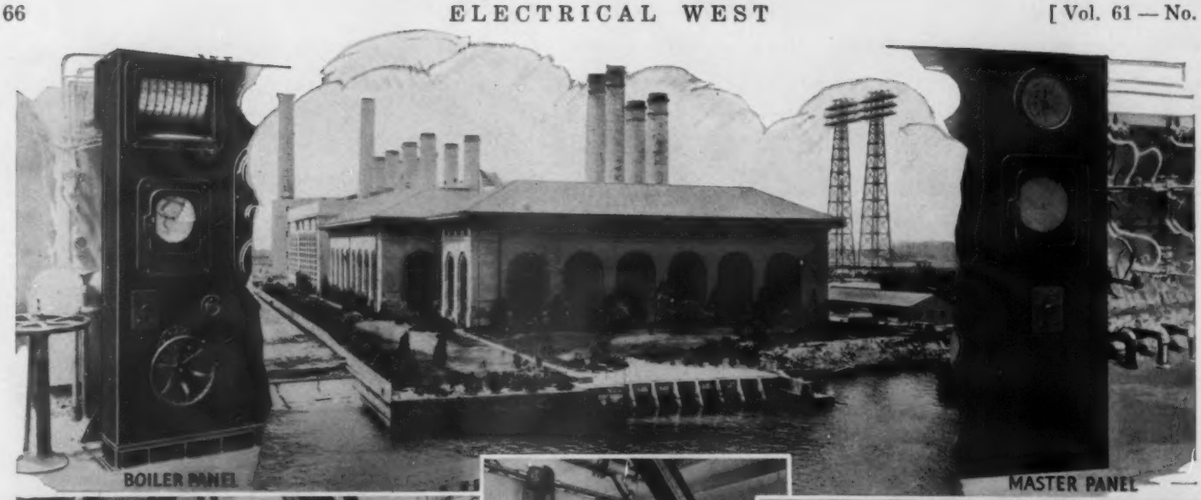
A closeup of the buckets assembled with disc and shaft. The bolting of each bucket has to withstand maximum impact forces of 100,000 lb. over 4 times each second as well as a maximum centrifugal force of 400,000 lb.

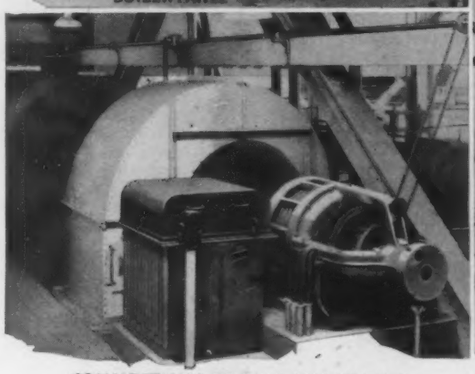
ALLIS-CHALMERS

MILWAUKEE. WIS. U. S. A.

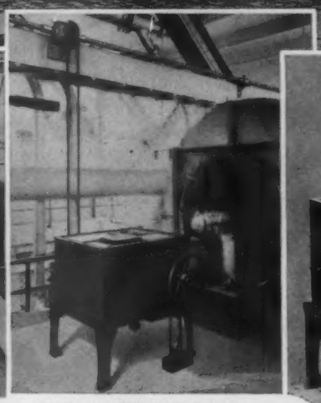
Southern California Edison Company

BIG CREEK

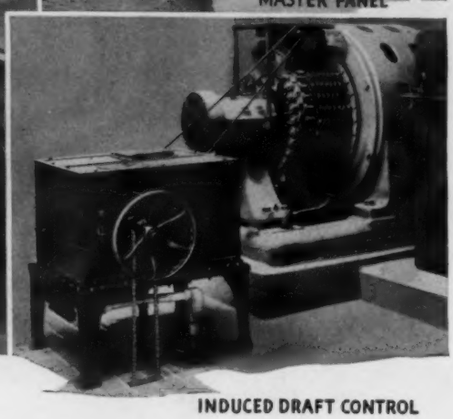




CONNECTIONS TO TWO BTS MOTORS DRIVING FORCED DRAFT FANS



FORCED DRAFT CONTROL



INDUCED DRAFT CONTROL

BAILEY METER CONTROL *at Long Beach*

THE third section of Long Beach Station of the Southern California Edison Company, containing three 1500 hp. boilers, is now operating under complete Automatic Bailey Meter Control.

Bailey Meter Control provides for the complete automatic control of one or a number of boilers. It regulates the quantity of fuel and air admitted to the furnaces of all boilers so as to satisfy the steam requirements as indicated by changes in the steam pressure. The air supply to each individual boiler is readjusted automatically to maintain the proper relation between the quantities of fuel and air to give best combustion efficiency. The forced draft is readjusted automatically to maintain a balanced draft, or a furnace draft which may vary slightly with boiler rating, if desired. All changes in steam pressure are therefore quickly corrected, and maximum economy is maintained at all times.

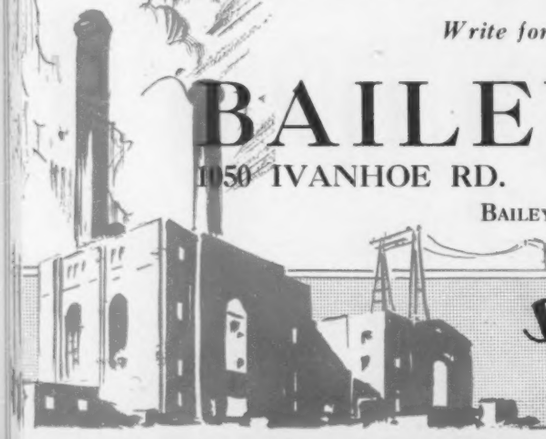
Bailey Meter Control is applicable to all types of boilers, and to stoker, pulverized coal, gas or oil firing. Every proposed installation is preceded by a comprehensive engineering survey of all operating factors.

Write for Bulletin No. 181 descriptive of Bailey Meters

BAILEY METER CO.

1050 IVANHOE RD. CLEVELAND, OHIO

BAILEY METER CO., LIMITED, MONTREAL, QUEBEC



Southern California Edison Company

LONG BEACH

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By using Foursome window and counter displays and Foursome literature —all in full colors — which are furnished to all our dealers.

By stocking up to take advantage of the Big National Foursome Advertising Campaign in Full Color in the Leading Magazines.

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Through the modern vogue of cheerfulness and brightness in home decoration to which the Foursome caters with its Six Beautiful Colors.

The FOURSOME

Tell them it multiplies the Convenience of your Electricity

Sell them — they encourage the use of more electrical appliances . . . .

COLT PATENT FIRE ARMS MANUFACTURING CO. HARTFORD, CONN. U.S.A.

Ask the jobber salesman, or

COLT'S PATENT FIRE ARMS MFG. COMPANY, Hartford, Conn.

C.P.F.A.M.CO. © 1928

The KOOL-PULL CORD SET

THE NEW COLT SUCCESS WITH THE RED PULL

HERE'S the best and quickest selling Cord Set you've ever seen. A new idea—a real idea—just what every woman has wanted.

Like the Foursome, it is moulded from "Coltrock", heat-resisting, permanent finish—with the new Red Pull that saves the Cord and prevents scorched fingers.

You find in KOOL-PULL the first Cord Set with real talking points—selling points that anyone can understand.

It's a great "Team-Mate" for the Foursome and you'll want lots of them. Both are Nationally Advertised in Full Color Magazine Pages—and will Sell, *Sell,* SELL.

Get your order to your jobber now, he has stocked for big, repeat orders.

All the bright, compelling displays and booklets you can use. Get these, also.

Insist that appliances you stock, come equipped with Kool-Pull Cord Sets.

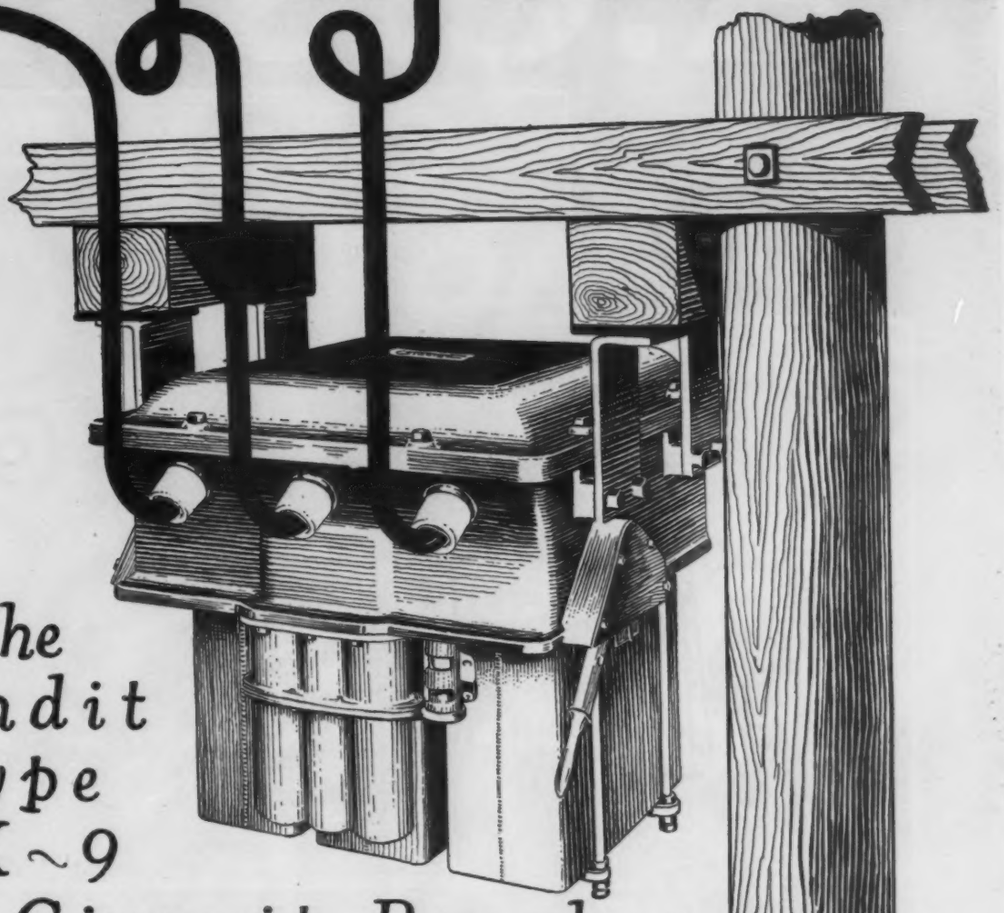
U.F.A.M. Co. © 1928

LITHO IN U.S.A.

Ask the jobber salesman, or write us direct—Don't delay.

COLT'S PATENT FIRE ARMS MFG. COMPANY, Hartford, Conn.

For Your Pole Lines



The Condit Type PK-9 Oil Circuit Breaker

A powerfully built, weather-proof breaker—just the thing for outdoor service of moderate interrupting capacity on pressures up to 7500 volts.

Furnished single or triple pole, non-automatic or automatic. Normal current ratings are 400, 600 and 800 amperes; 7500 volts.

Write Dept. G for full information.

CONDIT ELECTRICAL MFG. CORPORATION

Manufacturers of Electrical Protective Devices

BOSTON, MASS.

Represented by THE H. B. SQUIRES CO.,
Seattle San Francisco Los Angeles

1703

CONDIT

A.C.S.R.

From the Mountains to the Sea . . . . . .

The Bucks Creek to Brighton 220-kv. tie line of the Great Western Power Company transmits hydro-electric power from the watershed of the Feather River Canyon in the mountains of northwestern California to the cosmopolitan centers of Sacramento, San Francisco and Bay Region.

On this line running from the mountains to the sea, A. C. S. R. is used as a conductor.

ALUMINUM COMPANY OF AMERICA

2400 OLIVER BUILDING · · PITTSBURGH, PA.

RIALTO BUILDING · · · · SAN FRANCISCO

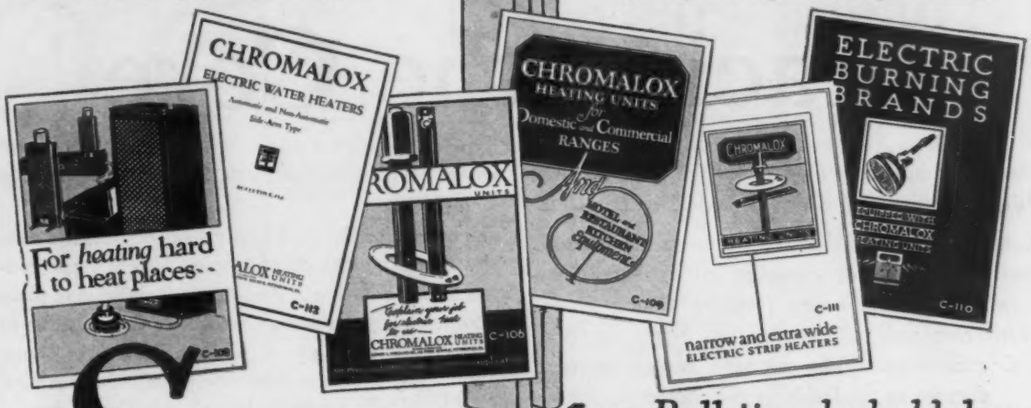
CHROMALOX
HEATING UNITS

INDUSTRIAL USES

Heating fluids, solids, air! Heating tanks of compounds... industrial equipment... special processes, heating anything from metal to grease... heating railway cars; here you have a few of the hundreds of jobs on which Chromalox Units have been operating three and four years *without quitting.* ★ Over 150,000 Chromalox Strip Heaters are in service on over 120 railways—the toughest kind of a job!

COMMERCIAL USES

And there's the same hard-service durability in the Chromalox Units built into electric irons and ironers... waffle bakers... percolators and big urns... sandwich toasters... ranges... and other appliances, and hotel and restaurant equipment. Dealers and jobbers selling the Chromalox-equipped products of over 60 manufacturers, no longer are bothered with the heating unit grief of repairs and replacements!



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Send me Bulletins checked below—

E.W 7-28

- ☐ C-106—Strip, Ring and Immersion Units
- ☐ C-108—Complete Electric Heaters
- ☐ C-109—Units for Hotel and Restaurant Equipment
- ☐ C-110—Electric Burning Brands
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*We Need Electric Heat for*_____

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Signed_____ Position_____

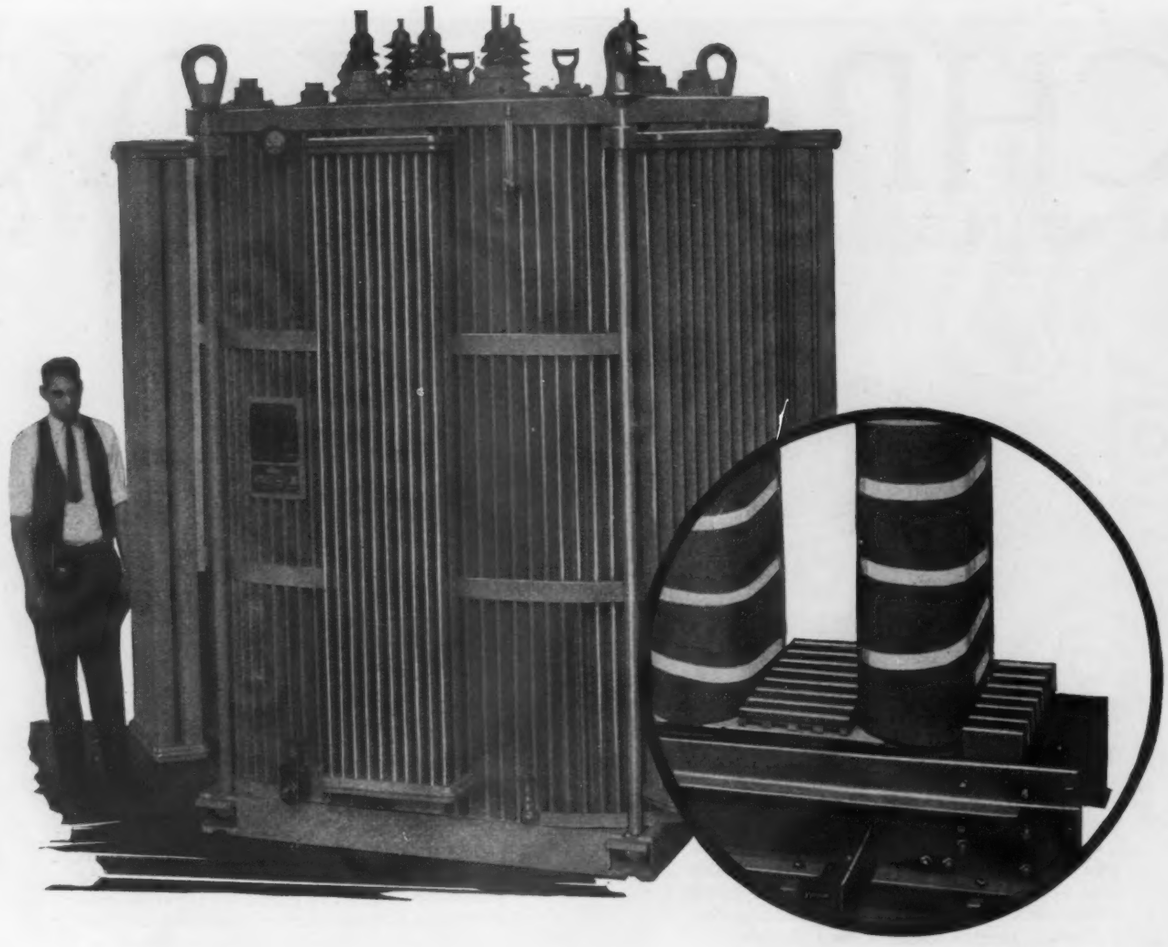
CHROMALOX HEATING UNITS

Manufactured Exclusively by

EDWIN L. WIEGAND CO., 422 FIRST AVENUE, PITTSBURGH, PA.

The Railway Utility Company of Chicago is sole distributor of Chromalox Strip Heaters for use in heating railroad and street cars in the United States and Canada. Sole Canadian Licensees: The Canadian Chromalox Co., Ltd., 251 Queen Street, East, Toronto, Ontario, Canada

Pacific Coast Representatives: THE ELECTRIC MATERIAL COMPANY, INC., 589 Howard St., San Francisco—443½ E. Third St., Los Angeles, Calif. HARRISON SALES COMPANY, 309 Lenora St., Seattle, Wash.



Bracing the Core

Here is found ample support for the large coils required on this 2500 KV-A 3 phase Packard Unit.

Note the cruciform-shaped core cross section with liberal wrappings of varnished cambric and press board. This construction provides a snug fit between core and coil resulting in better electrical characteristics. The rounded corners prevent damage to the inside of the windings.

Between core legs the coils rest upon oil-treated, hard maple dowelled lattice work which is designed for maximum strength with minimum interference to circulation of oil.

The braces for the outside edges of the coils are likewise of oil treated, hard maple, dowelled pin construction. They are so designed and clamped in place as to positively prevent movement of the coils due to short circuit or heavy surge condition on the transformer. At the same time they permit the free flow of oil vertically through the coil winding ducts.

Strong steel angle supporting structure with channel iron braces, provide a firm foundation for the transformer interior.

For further information as to how Packard Power Transformers are built—use the coupon.

THE PACKARD ELECTRIC CO., Transformer Division, Warren, Ohio

I would be interested in receiving further information as to how Packard Power Transformers are built.

Name and position.....

Company .....

Address .....

The Packard Electric Company Warren, Ohio

Packard is never seen except on goods of honest value

"Established 1890"

Western Representatives

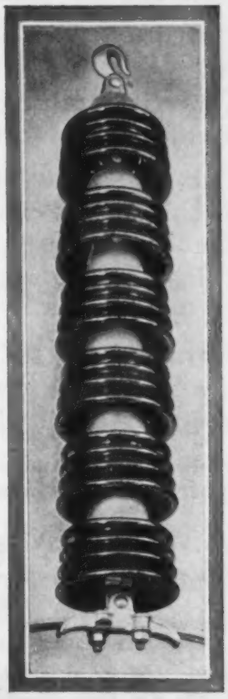
T. S. Wood, 505 Polson Bldg., Seattle

A. J. Myers Co., 607 Call Bldg., San Francisco

W. W. LaBarr, 522 Chamber of Com. Bldg., Los Angeles

Fog Suspension Unit
No. 5805

Why are Lapp Fog Type Insulators five years ahead?



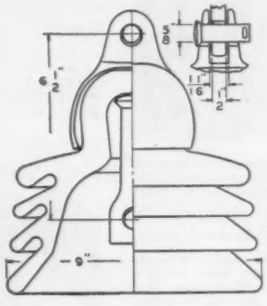
BECAUSE they provide a 30% to 60% greater length of resistance surface—each inch of greater effectiveness than on ordinary insulators. Therefore, they "hold in" without attention, under conditions of contamination where ordinary insulators require frequent washing or replacement.

BECAUSE one or several "petticoats" or shells can be broken with *no reduction in dry, clean flashover voltage* or all broken with but slight reduction.

BECAUSE "petticoats" are shorter, more rugged, and at least twice as strong as ordinary types for withstanding impact of stones, bullets, etc.

BECAUSE they are one-fourth the diameter of ordinary types, allowing closer spacing on pole tops, switches, etc.

Our new Catalog No. 4 gives full details.



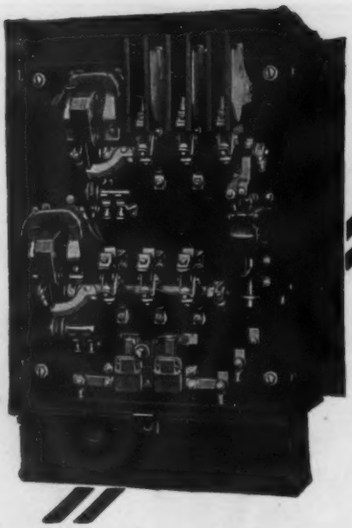
Lapp Insulator Co., Inc.

Le Roy, New York, U. S. A.

Pacific Coast Representatives—Los Angeles, Calif., S. Herbert Lanyon, 210 Transportation Bldg. San Francisco, Calif., S. Herbert Lanyon, 509 New Call Bldg. Seattle, Wash., W. R. Hendrey Co., Hoge Bldg.

C-H Primary Resistor Starters

Built to the standard of Millions of operations



Have passed every test you can give them

A few C-H advanced features

1 *Thermal Overload Protection. Cuts motor from line only when heating of motor windings becomes dangerous. Easily reset from outside of case.*

2 *Overload relay easily adjustable to insure maximum output from motor without danger to windings.*

3 *Thermal Overload Relays easily and quickly reset from outside of starter case.*

4 *Double pull solenoid type magnet. Quick, powerful, positive pull insures full roll-and-rub contact action. Cool operation of contacts and freedom from pitting assures long life.*

5 *Magnet coils easily demountable. Saves valuable time in replacing coils injured by abuse or accident.*

6 *Hardened and ground steel bearings used for switch mechanism. Adjustable to compensate for wear through years of steady service.*

7 *Every starter part designed for quick replacement. This is most valuable service insurance—constant protection against shut-downs, even in the face of abuse to the starter.*

8 *Chimney type arc shields and heavy blow-out coils quickly carry arc away from contacts, greatly increasing their life. Note simple removal of arc shields.*

NO matter what demands your plant makes on motor starters—no matter if other starters have failed to meet your needs—C-H Primary Resistor Starters had to pass every test *any* plant could offer before a single one was sold.

C-H Primary Resistor Starters were designed "under fire". Years of severe service were crowded into weeks of merciless testing. Possible weaknesses were "hounded out"—corrected.

The most trying tests ever devised for motor protection were passed. Unequalled ease of servicing all the important working parts was achieved. Problems of installation were foreseen and overcome.

No wonder these Starters have set a new standard of performance in actual service. A careful check of the features will tell why.

Secure these advantages on your A. C. Automatic Starter installations by specifying Cutler-Hammer.

The CUTLER-HAMMER Mfg. Co.

Pioneer Manufacturers of Electric Control Apparatus

1222 St. Paul Avenue Milwaukee, Wisconsin

Pacific Coast Offices: 970 Folsom St., San Francisco
220 Boyd St., Los Angeles 2203 First Ave. So., Seattle

CUTLER HAMMER

The Control Equipment Good Electric Motors Deserve

Indoor Style Terminal

Outdoor Style Terminal

Are Your Cables Insured by the Right Kind of Terminals?

We have compiled some facts in catalogue form which should enable you to select the most effective terminals, and insure your transmission system against expensive service interruptions from this cause.

This catalogue explains why you should select terminals by flashover values rather than by voltage ratings, what the size and shape of insulators have to do with high flashover values, why insulators should be readily removable from the terminal cap, the advantages of bimetallic nipples, and many other points of interest to terminal users.

Your copy of this new STANDARD Terminal Catalogue will be sent on request.

STANDARD UNDERGROUND CABLE CO.

Division of General Cable Corporation

General Offices: Pittsburgh, Pa.

Branch Sales Offices: Boston Philadelphia Atlanta Chicago St. Louis Seattle New York
Washington Pittsburgh Detroit Kansas City Los Angeles San Francisco

For Canada: Standard Underground Cable Co. of Canada, Ltd., Hamilton, Ont.

Our New Electric Rates

An aid in greater merchandise sales

WHERE P. G. and E. domestic consumers have lighting service and in addition use electric appliances totaling 1000 watts or more capacity, the new Domestic rate applies.

Many consumers heretofore using only lighting service are now purchasing heaters, toasters, irons and other appliances and secure a rate of 3½ and 1½ cents per kilowatt hour for energy used through these convenient labor-saving devices.

Live electrical dealers, contractors and jobbers are cashing in on this opportunity and introducing new electrical equipment into many homes.

PACIFIC GAS AND ELECTRIC COMPANY

P·G·and E·

Owned · Operated · Managed
by Californians

ANNOUNCING

The Prize Winners *in the*

Premier Family Display Contest

The Electric Vacuum Cleaner Company extends its thanks to all those who participated in the Premier Family Display Contest from March 26 to April 7, 1928. Not only did these companies increase their sales enormously—but many of them cashed in on the Premier Window Display Contest Prize Money. The names of the winners are listed here.

GRAND PRIZE — 1928 CHEVROLET

Mr. C. W. Ahlroth The May Company Los Angeles, Cal.

FIRST PRIZE—$100.00—CLASS A

Mr. O. J. Hinrichs	The Toledo Edison Company, Toledo, Ohio.

CLASS B

Mr. G. F. Tibbetts	Forbes & Wallace, Inc., Springfield, Mass.

CLASS C

Mr. J. U. Berry	Valley Electrical Supply Company, Fresno, Calif.

SECOND PRIZE—$75.00—CLASS A

Mr. J. M. Shollar	Penn Central Light & Power Company, Altoona, Pa.

CLASS B

Mr. P. J. Bellanca	Hens & Kelly Company, Buffalo, N. Y.

CLASS C

Mr. A. L. Flower	Elmwood Electric Shop, Buffalo, N. Y.

THIRD PRIZE—$50.00—CLASS A

Mr. W. B. Harris	Knoxville Power & Light Company, Knoxville, Tenn.

CLASS B

Mr. W. N. Speer	W. C. Stripling Co., Fort Worth, Tex.

CLASS C

Mr. N. A. Franks	The Good Housekeeping Shop, Detroit, Mich.

HONORABLE MENTION—$10.00—CLASS A

Mr. H. H. Bauck	Associated Gas & Electric System, Ithaca, N. Y.
	City of Calgary Electric Light & Power Co., Calgary, Alta.
Mr. G. F. Kuzell	The Cleveland Southwestern Railway & Light Co., Crestline, Ohio
Mr. J. L. Ryan	Empire Gas & Electric Company, Auburn, N. Y.
Mr. Rudy Hilgedick	Indianapolis Power & Light Co., Indianapolis, Ind.
Mr. A. F. Clark	Kansas Gas & Electric Company, El Dorado, Kans.
Mr. G. B. Haygood	New Orleans Public Service, Inc., New Orleans, La.
Mr. R. M. Angell	New York Power & Light Corp'n., Schenectady, N. Y.
Mr. E. Morrison	Northwestern Electric Company, Portland, Ore.
Mr. J. Brown	San Diego Consolidated Gas & Electric Co., La Jolla, Calif.

CLASS B

	T. Eaton Company, Toronto, Ont.
	Hudson's Bay Company, Calgary, Alta.
Mr. M. H. Luber	The Killian Company, Cedar Rapids, Ia.

HONORABLE MENTION—$10.00 (*Continued*)

Mr. G. E. Tedeschi	Meekins, Packard & Wheat, Springfield, Mass.
Mr. W. T. Dwyer	Shartenberg & Robinson Co., New Haven, Conn.

CLASS C

Mr. L. W. Knecht	General Washing Machine & Repair Company, Cleveland, Ohio
	Frank B. Hill, Waynesburg, Penna.
Mr. T. E. Engelhardt	Jennison Hardware Company, Bay City, Mich.
Mr. H. W. Paffendorf	C. H. Paffendorf & Sons, Newburgh, N. Y.
Miss Evelyn Johnston	Winfield Electric Company, Winfield, Kan.

HONORABLE MENTION—$5.00—CLASS A

Mr. M. A. Glass	Alabama Power Company, Anniston, Ala.
Mr. C. W. Caldwell	Beverly Gas and Electric Company, Beverly, Mass.
Mr. E. A. Mattson	Citizens Gas & Electric Co., Council Bluffs, Iowa
Mr. H. E. Carson	Edison Light & Power Company, York, Penna.
Mr. J. A. Minster	Elmira Water, Light & Railroad Co., Elmira, N. Y
Mr. Martin L. Tonner	Iowa-Nebraska Light & Power Co., Norfolk, Neb.
Mr. J. C. Penberthy	Ohio Public Service Co., Mansfield, Ohio
Mr. C. M. England	Penn-Ohio Power & Light Co., Lisbon, Ohio
Mr. E. F. Dahlheim	Portland Electric Power Company, Hillsboro, Ore
Mr. J. Brook	San Diego Consolidated Gas & Electric Co., La Mesa Cal.
Mr. W. T. Conlon	Utica Gas & Electric Co., Utica, N. Y.

CLASS B

Mr. Theo. Weigel	E. W. Edwards & Son, Buffalo, N. Y
Mr. T. J. McCormack	People's Outfitting Co., Detroit, Mich.
Mr. M. R. McDonnell	J. H. C. Petersens Sons Co., Davenport, Iowa
Mr. W. L. Clush	Pomeroy's, Inc., Harrisburg, Pa.
Mr. J. C. Mackey	M. Rich & Bros. Co., Atlanta, Ga.
	Smallman & Ingrams, Ltd., London, Ont.
Mr. M. B. Wallace	Taylor Brothers Company, Provo, Utan

CLASS C

Mr. R. H. Pow	Euclid-Taylor Electric Co, East Cleveland, Ohio
Mr. L. E. Drossart	Green Bay Hardware Company, Green Bay, Wis.
Mr. G. H. Foster	Haskell Electric Co., Holyoke, Mass.
Mr. R. E. Rosenbarger	Indiana Furniture Co., Fort Wayne, Ind.
Mr. Mervin Levy	Levy Electric Company, San Francisco, Cal.
Mr. R. O. Mulligan	Reliance Electric Service Co., Los Angeles, Calif.
Mr. S. M. Whinihan	Whinihan Bros. & Co., Inc., Buffalo, N. Y.

ELECTRIC VACUUM CLEANER CO., INC., Dept. 907, Cleveland, Ohio

Distributed and serviced on the Pacific Coast by the Premier Service Company with branch offices in Los Angeles, San Francisco and Portland. ¶Manufactured and distributed in Canada by the Premier Vacuum Cleaner Co., Ltd., General Offices, Toronto. ¶Sold over the entire world, outside of the U. S. and Canada by the International General Electric Co., Inc., Schenectady, New York.

The Wringer-less Apex SPINS

The Apex Line enables Apex dealers to carry a full line of quality appliances under the one nationally known name —Apex. This simplifies the selling job.

THIS newest washer includes several important "patented" features that from a performance standpoint put it in the lead of all washers. Dealers who sell this Apex are INVINCIBLE. Point by point they win with this Apex—the washer *supreme* —the washer that is unsurpassed for washing—drying—draining—for SAFETY and QUIETNESS —for compactness and appearance. Think of THIS! One man can handle it—and it takes up less room than an ordinary washer—STILL, it washes 8 pounds of clothes (dry weight) in 5 to 8 minutes and spins them dry in less than 2 minutes.

The washing or drying compartments, or both, are quickly and automatically drained by the simple twist of a handily placed and well marked control.

WashClean and Spin Dry

is the method that is now the vogue. The Apex "spinner-dryer" spins on only ONE BEARING. There is no top bearing to be fitted in place before the "spinner-dryer" can be operated. This one feature alone puts Apex in the lead of all washers.

The Apex Electrical Manufacturing Co.
Cleveland, O., U. S. A.—Toronto and Montreal, Can.

PENINSULAR

The Range You Would Sell Your Best Friend

AND that is the kind of a range you want for your customers—one you can personally recommend in the most unqualified way.

Nearly a half century of stove building for a background—four years of development before a single range was sold—electrical features by the aid of the best experts we could hire—these factors have made the Peninsular Electric our masterpiece of range building.

Among the eleven models you can find every feature to meet the desires of all varieties of trade. Every model is an exceptional value—has no superior in its class.

COLOR

Four colors in vitreous porcelain enamel available—Mandarin Red, Chinese Yellow and French Grey.—Entrancingly beautiful to delight the feminine eye.

These Ranges can be furnished with balanced load switches if so ordered.

Write for new catalogue — prices, etc.

THOMAS E. REED, Pacific Coast Representative, Machinery Exchange, 533 Market St., San Francisco

PENINSULAR
PENINSULAR FEATURES—
Porcelain enamel—all Over—Cast iron legs—cooking top—oven door frame—Strength where strength is needed—Oven porcelain enamel—inside and out—can't rust—Two inches mineral wool insulation, all around oven—Peninsular Roller oven door catch—can't cause trouble—Oven heat closely regulated by thermostat—optional with clock to turn on heat at predetermined time—All heating units made by best manufacturer we could find. You have replacers in your own stock room.

DETROIT **THE PENINSULAR STOVE CO.** **CHICAGO**

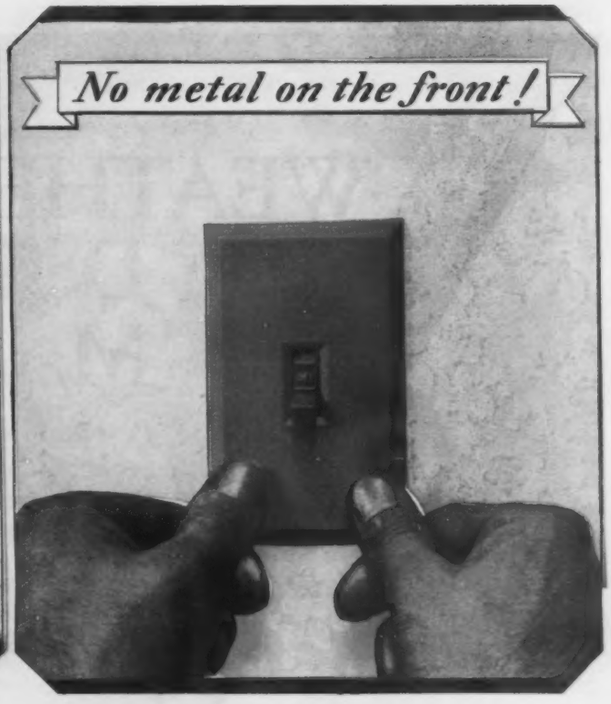
An Amazing Public Tribute!

- two thousand carloads of General Electric Refrigerators delivered to users since April first

Nine factories are now working at full capacity to take care of the increasing volume of business

GENERAL ELECTRIC
Refrigerator

ELECTRIC REFRIGERATION DEPARTMENT · OF GENERAL ELECTRIC COMPANY · HANNA BUILDING · CLEVELAND, OHIO



A perfectly insulated *"Dead-Front"* Bakelite Plate!

No metal touches the surface—No screwheads project to carry current

NO metal fastening of any kind—not even a screwhead—comes through to the surface of a Hubbell *Screwless* Switch or Outlet Plate of Bakelite. The electrical device is safely sealed behind it—even static shocks are impossible.

The Screwless Bakelite Cover Plate is snapped onto, and firmly supported by, a stiff steel under-plate, cadmium-plated and rust-proof.

Metal under-plate carries the switch or receptacle and when mounted on the plaster over the outlet box therefore *automatically* brings the switch or receptacle flush with the plaster line. None of the usual time-wasting "building-up" is necessary.

Hubbell Screwless Plates of Bakelite are made in types for every purpose. They may be had to duplicate any color or shade, or to match the color and grain of wood or marble.

Send now for our latest A. I. A. Bulletin No 31c-7 containing complete information.

For your convenience:– the coupon below.

HARVEY HUBBELL, Incorporated
BRIDGEPORT, CONNECTICUT, U. S. A.

HUBBELL *Screwless Plates*

Mail coupon to our nearest office
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Atlanta, Georgia
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216 E. Lexington St.

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Chicago, Illinois
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San Francisco, Cal
390 Fourth St.
Garnett Young & Co.

Please send A. I. A. Bulletin No. 31c-7

Name _____

Address _____

City and State _____

E.W. 7-28

WEATHERPROOF In Design and Material

Powerlet V-A Type Fitting
See New Catalog No. 33

The UNION-GEM JEFFERSON Line is Sold Through Jobbers

Gem Powerlet Rigid Conduit Fittings are designed to outlast the building or machine on which they are installed. The V-A Type Fixture, illustrated above, is an example of the care with which all Powerlets are constructed.

The husky iron body is heavily galvanized—rustproof, regardless of exposure. The design assures permanent vapor and moisture proofing.

Hubs of Gem Powerlets are all threaded accurately and for full length providing permanently waterproof joints. Guards are of brass, designed to cut down shadows to a minimum.

Other equally important features of Gem Powerlets are described in the new Catalog No. 33 which lists all types and sizes. Write for your copy.

Chicago-Jefferson Fuse & Electric Co.
1521 West 15th Street, Chicago

GEM POWERLETS

CONDUIT FITTINGS

(4702)

As they Say at Peter Cailler Kohler Swiss Chocolates Co., Inc.

Class 8527
Automatic A. C. Across-the-Line Starter with push button control

Write for Bulletin

Mr. E. E. Besse, *Chief Engineer of the Peter Cailler Kohler Swiss Chocolates Co. Inc., at Fulton, N. Y., says:*

"Peter's and Nestle's milk chocolate are manufactured in this modern plant, which is completely electric in operation. Since 1926, Industrial Controller Automatic Starters, Class 8527, have been installed on some 60 motors ranging up to 7½ H. P., and are standard on all new drives of this size.

"Most machines used in the plant must be stopped and started several times a day. Where operators formerly operated hand starters slowly, causing arcs and damage, I-C push button control has entirely eliminated this source of trouble. In starting, motors are brought up to speed smoothly without regard to the skill of the operator. Preventing jerky starting, lengthens the life of both motors and machines.

"In emergencies, motors can now be stopped quickly simply by touching a button. In case of overload or phase failure, the I-C overload relays stop the motor automatically. When the cause of the overload is remedied, the motor is started again without calling an electrician. This shortens shutdown time and saves electricians' time.

"Not a motor connected to an I-C starter has been damaged from any cause due to starter failure."

Industrial Controller Co.

MILWAUKEE, WIS. U.S.A.

C. E. INGALLS, Rialto Bldg., San Francisco; Citizens National Bank Bldg., 453 South Spring St., Los Angeles.
ROBINSON SALES CO., Polson Bldg., Seattle: 53 Fourth St., Portland.

Type "RA" Single-phase Repulsion—Induction motor—½ to 7½ H.P.

Appliance Sales Made Easier

To promote the constant use of modern electric, motor driven, household appliances—with the load-building opportunities they present—requires first of all, dependable appliances.

Robbins & Myers reputation is world wide. The name is so widely and favorably known that when the salesman says, "It's a Robbins & Myers motor," the question of dependability is at once definitely settled.

Electric appliance sales are made easier because of less sales resistance. Furthermore, you are confident that the electric appliances you sell will give utmost satisfaction—with virtually no servicing.

Investigate our complete engineering service — on any type of motor service.

Robbins & Myers, Inc.

Springfield, Ohio Brantford, Ont.

West Coast Distributors

Stewart Elec. Co.,
2400 1st Ave., So.
Seattle, Wash.

Walter G. Preddey,
187 Golden Gate Ave.,
San Francisco.

Buckner-Woodard Co.,
1743 1st Ave., So.,
Seattle, Wash.

Hampton Elec. & Mfg. Co.,
525 Howard St.,
San Francisco.

Langman Elec. & Mfg. Co.,
407 Davis St.,
Portland, Ore.

The Motor Shop,
210 E. 3rd St.,
Los Angeles, Cal.

Robbins & Myers
Fans and Motors

Above: A typical order selected from Graybar's well-stocked shelves and ready for packing.

Everything electrical —*in one "marketing"*

You can get sixty thousand items or one — in a single transaction with the nearby Graybar distributing house!

Why go marketing when Graybar has brought the entire electrical market within hailing distance of your doorstep?

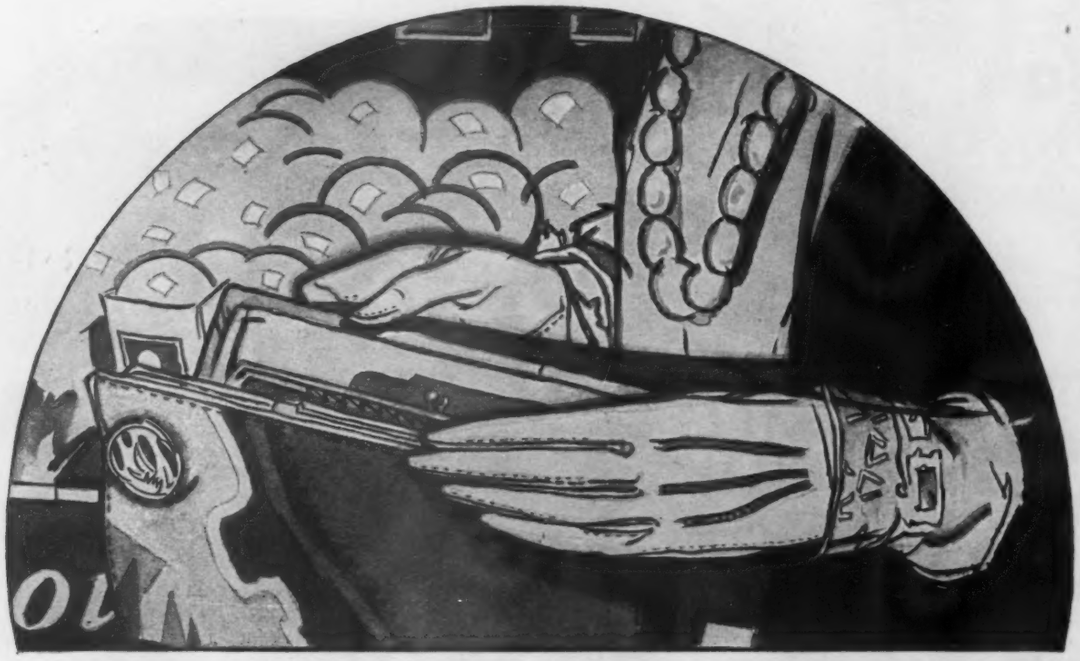
Not only that. Graybar has placed the endorsement of its fifty-nine years' experience on the items it supplies. From the motor to the meter, from the lamp to the power line, your electrical installation can be of one uniformly high quality—Graybar quality.

GraybaR

Successor to *Western Electric* Supply Dept.

The Graybar Tag —symbol of distribution

PORTLAND TACOMA



FINGERS THAT CONTROL YOUR REVENUE

One or Six?

Will her fingers extract 25c for one lamp, or $1.50 for a carton of six? You know that carton purchases assure spare lamps in the home. And spare lamps eliminate empty sockets. Hence the importance of selling lamps by the carton.

Statistics show that the potential revenue lost annually because of empty sockets exceeds an entire month's output of the U. S. Mint. Remember—lighting produces three-fifths of all your revenue!

Our sales promotion specialists have made a thorough study of the empty socket market. And they have developed a practical, proven sales activity on Edison MAZDA* Lamps which enables you to capitalize this profitable market.

We shall be glad to show you how this plan may be adapted to your particular needs. Just drop a line to the Publicity Department, Edison Lamp Works of General Electric Company, Harrison, N. J.

*MAZDA—*the mark of a research service*

EDISON MAZDA LAMPS

GENERAL ELECTRIC

Just Out!

472 Pages

6 x 9

150 Illustrations

$5.00 Postpaid

All you want to know about every phase of electric heating . . . . .

The fundamentals of heat; electric fundamentals; resistor elements and heating units; cooking; apartment heating; ultra-high-temperature ovens; electric smelting of ores; welding and cutting; temperature measurement and control; facts, figures, design data, tables formulae, drawings, illustrations—everything about electric heating.

Published May, 1928

ELECTRIC HEATING

By EDGAR A. WILCOX
Consulting Engineer

This new book contains the whole story of electric heating. It is a book for central station men, engineers in all fields, salesmen and executives who feel the need for a well-rounded knowledge of electric heating in all its aspects.

The Book Gives Detailed Coverage for Such Topics As:

—relative cost of fuel and electric heat;
—heat flow through materials;
—nickel-chromium resistor calculations;
—electric conveyor bread ovens;
—water heaters;
—construction of electrically heated buildings;
—varnish drying ovens;
—ovens for jappanning;
—electric annealing furnaces;
—iron- steel- and brass-melting furnaces;
—electric ore smelters;
—automatic arc seam-welding machines;
—butt- and spot-welding;
—the advantages of electric steam boilers;
—electric laundry and clothing manufacturers' irons;
—temperature measurement and control;
—thermal insulation;
—etc., etc., etc.

Read This List of Chapter Headings

I.—Introduction;
II.—Fundamentals of Heat;
III.—Electric Fundamentals;
IV.—Resistor Elements and Heating Units;
V.—Cooking;
VI.—Water Heating;
VII.—Air Heating;
VIII.—Oven Heating;
IX.—Heating Furnaces;
X.—Iron- and Steel-melting Furnaces;
XI.—Brass-melting Furnaces;
XII.—High-frequency Furnaces;
XIII.—Pot Furnaces;
XIV.—Miscellaneous Furnace Applications;
XV.—Arc Welding;
XVI.—Resistance Welding;
XVII.—Metal Heaters;
XVIII.—Sterilizers, Stills and Steam Boilers;
XIX.—Liquid Heating and Compound Melting Pots;
XX.—Incubators and Brooders;
XXI.—Miscellaneous Heating Appliances;
XXII.—Metal Coatings;
XXIII.—Temperature Measurement and Control;
XXIV.—Thermal Insulation.

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You may send me on 10 days' approval Wilcox—ELECTRIC HEATING, $5.00 postpaid. I agree to remit for the book or return it postpaid within 10 days of receipt.

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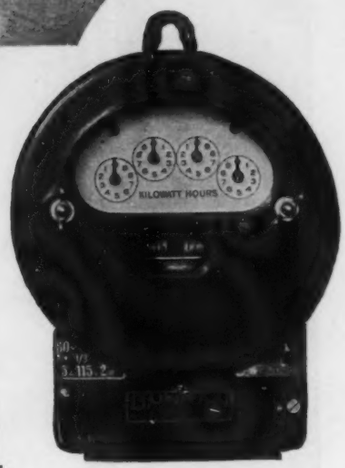
(Book sent on approval to retail purchasers in the U.S. and Canada only.) O. 7-1-28



Just before the Packing ~ The Final Check on *Duncan Accuracy*

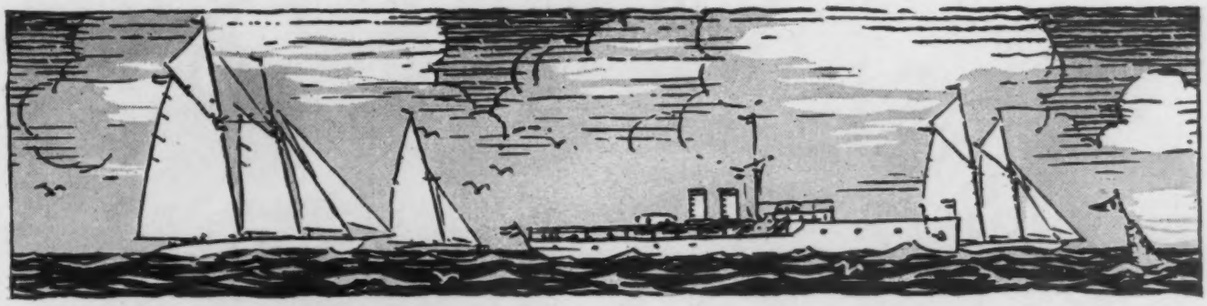
Check—check—check—at every step of the way, and most important of all, at the end of the journey through the factory. For so jealous are we of the Duncan reputation for accuracy that the last thing we do before packing Duncan Watthour Meters is to impose a final check test on all adjustments,—light load, heavy load, and quadrature.

Our testing laboratory is equipped with every possible device for making the tests, tests which insure that Duncan Meters possess, at the beginning of their careers, that accuracy which their sound design and manufacture insure will be sustained in service.

DUNCAN ELECTRIC MANUFACTURING CO., LAFAYETTE, IND.

DUNCAN
Watthour Meters

A. F. BLECKSMITH, 547 Douglas Bldg., Los Angeles
GEORGE L. HOFFMAN, 202 Oregon Bldg., Portland



If You Want Smooth Sailing–

on wiring jobs, use these Quality Wiring Materials. ► Durabilt Products are helping Electrical Contractors, everywhere, to do the best wiring jobs with the

Greatest Possible Speed

These Quality Products Speed Up Wiring Jobs

DURAWIRE
Rubber-Covered Wire and Flexible Cords

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The Safe Armored Cable and Flexible Steel Conduit

DURACORD
The heavy-duty Portable Cord

DURADUCT
The fast-fishing Single-Wall Loom

DURAX
The Non-Metallic Sheathed Cable of Known Quality

DURABILT PRODUCTS

REG. U.S. PAT. OFF.

C. DENT SLAUGHTER

Pacific Coast Representative

314 12th Street, San Francisco
336 East 4th Street, Los Angeles
355 Everett Ave., Portland
524 First Ave. So., Seattle

Stocks carried at all coast jobbing centers

The new SANGAMO

TYPE HC METER

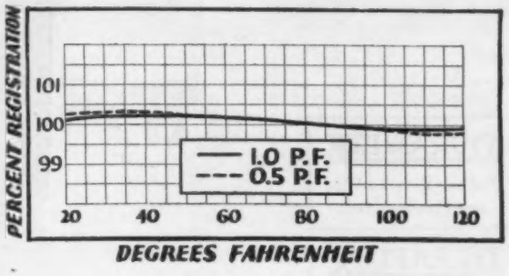
ACCURATE AT ALL POWER-FACTORS

From 20 deg. to 120 deg. Fahrenheit

THE problem of producing the fully temperature-compensated Type HC Meter, without radical changes in the design of the reliable Type H, has been successfully worked out by Sangamo engineers. Briefly, the use of thermal responsive magnet supports and a thermal responsive insert in the tip of the shunt magnet has resulted in temperature compensation on both non-inductive and inductive load over a wide range, from 20 deg. to 120 deg. Fahrenheit. The non-technical observer would not notice the difference in construction.

THE load curve of the HC is simply described—straight-line accuracy up to 300 per cent. Voltage and frequency errors are negligible, as in most modern, high-grade meters.

MECHANICAL changes provide a reinforced metal cover and permanent magnets accurately located and positively locked in position. The weight of the HC moving element and the torque are the same as in the Type H. The speed has been reduced and the direction of rotation reversed. In short the HC meter has been standardized and modernized in every respect.



The HC Meter is fully described in an addenda to Bulletin 67, which will be sent on request.

86-8137-26

SANGAMO ELECTRIC COMPANY, SPRINGFIELD, ILLINOIS

The new H&H Catalogue

HERE you'll have all our new developments of the past year or more—*besides* up-to-date listings of all your old standbys in the H&H line of Switches and Wiring Devices. The stuff successful jobs will be built around this year, and for years to come.

The contents of this new book are calculated to give you every advantage in Quality at the prices listed. You'll be able to meet competitive bids with material above the competitive class, in point of service to your customers.

To make sure you'll get an early copy of the Catalogue, fill in the Coupon at right; mail it today if possible.

To The Hart & Hegeman Mfg. Co., Hartford, Conn.

Gentlemen:

SEND ME an early copy of your new "Catalogue T."

Name .....

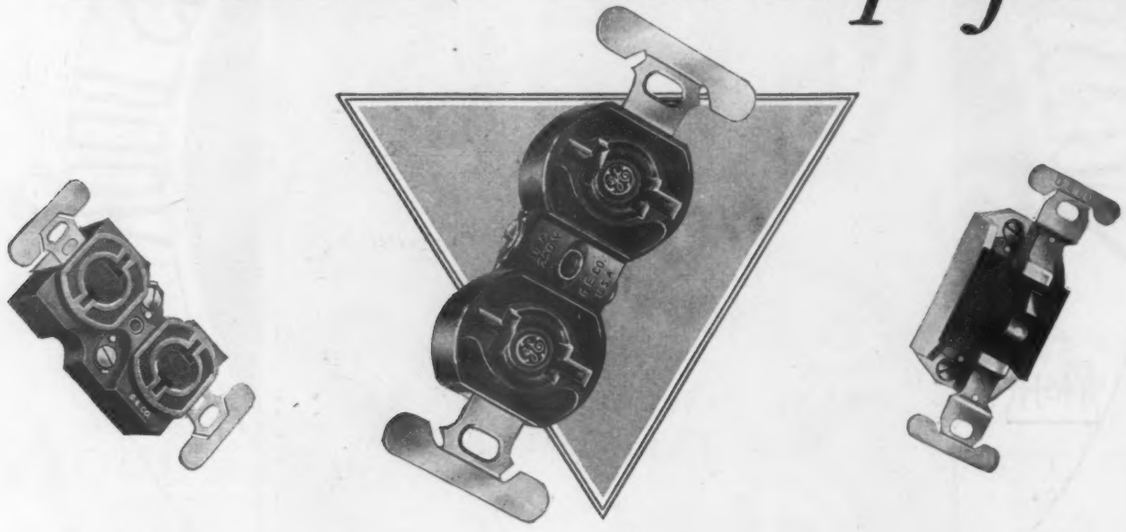
Street and No. .....

Town & State .....

THE HART & HEGEMAN MFG. CO.

HARTFORD, CONN. MAKERS OF ELECTRIC SWITCHES SINCE 1890

This NEW wide-ear *convenience outlet Saves time -Builds profits*



Available now, for the first time, in the lower-priced side-wired outlet, as well as the top-wired outlet and the tumbler switch

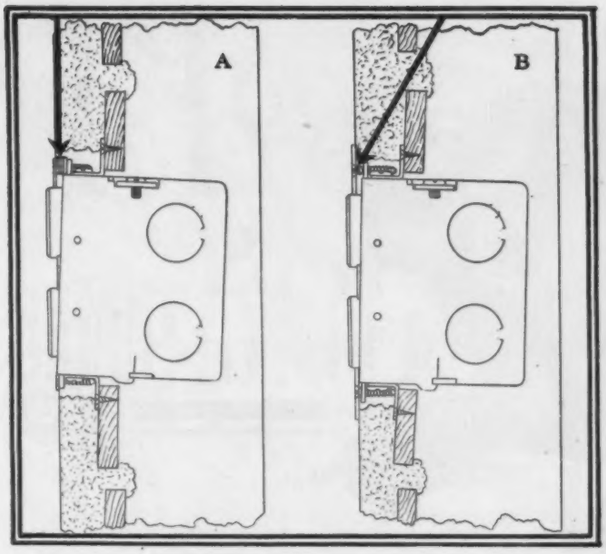
TIME is money—and oftentimes the profit on a wiring job is controlled by the time spent on it. To speed up your work and to assure absolute efficiency without any extra labor, General Electric offers these new convenience outlets with wide ears.

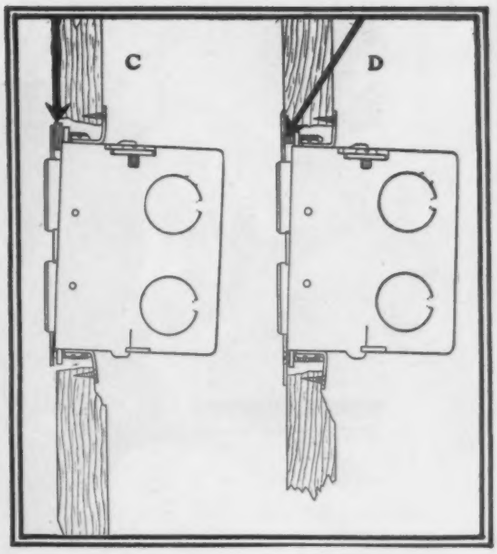
Now you no longer need washers to raise flush devices to the right height to make the plate fit properly. General Electric flush devices with wide ears always rest *squarely on the surface* of the wall and insure proper seating.

If you will look at the pictures on the page opposite you will see at a glance how much more efficient these outlets are—how much quicker to install. Use them always—to save precious minutes and build up bigger profits.

General Electric flush devices with wide ears can be obtained from General Electric Merchandise Distributors.

750—286





A

Shows a cross section of a flush device mounted in a box which is tipped backward in the wall (a common condition). In order to overcome this, it was necessary to use washers to shim the outlet up into proper position.

B

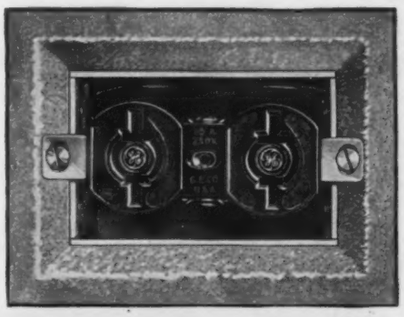
Illustrates a wide ear outlet installed in the same box. Because the ears rest on the plaster, the outlet automatically falls into proper position when the screws are drawn up.

C

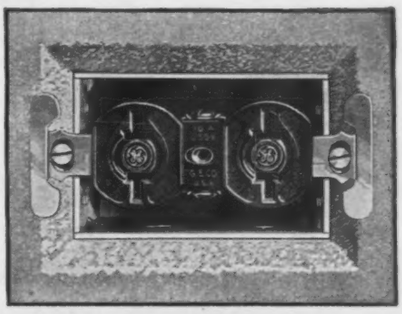
A cross section of an old type outlet mounted in a box which (as is quite common) was not flush with the wood partition to which it was fastened. The arrow indicates washers necessary to bring the outlet into proper alignment.

D

Shows a new wide ear outlet mounted in the same box. The outlet is in correct position due to the fact that the ears rest on the surface of the partition.

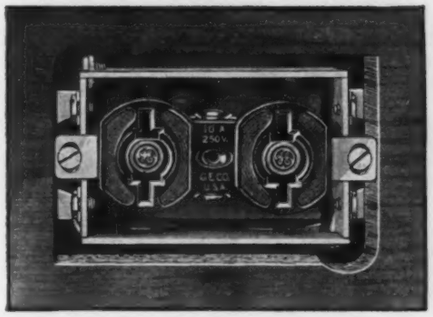


E

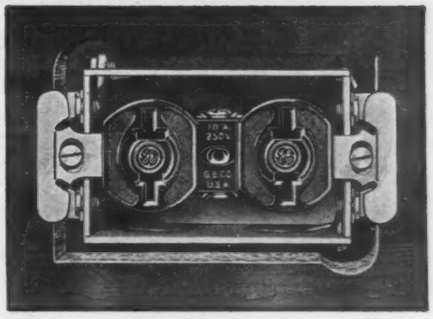


F

E—Shows a box which was mounted below the surface of the plaster. The old type outlet put in this box will fall below the surface as illustrated. "F" shows the new type outlet which, because of its wide ears rests in the proper plane.



G



H

G—Shows the same situation when the old type outlet is mounted in a baseboard. In "H" you see the new wide-ear convenience outlet, resting squarely on the surface to give the plate an accurate mounting.

• • •

And—in case you wish to remove the wide ears for old work—a pair of pliers will do the job in a second.

GENERAL ELECTRIC

WIRING MATERIALS

5 Horse Power Century Type SC Squirrel Cage Induction 3 and 2 Phase Motor

ANTI-FRICTION BEARINGS

In addition to the regular Century Phosphor Bronze Sleeve-type Bearings, Century Type SC Squirrel Cage Induction 3 and 2 Phase Motors can also be furnished with Anti-Friction Bearings of liberal dimensions. Built in all standard sizes from ¼ to 100 horse power Temperature rise not more than 40° C.

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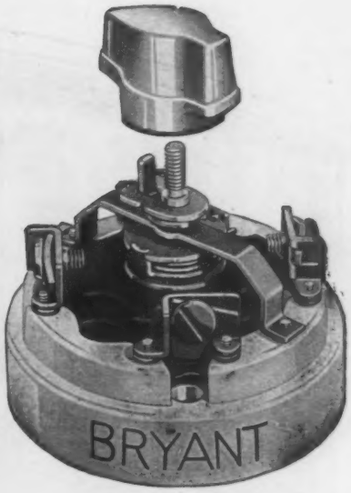
Century MOTORS

"THEY KEEP A-RUNNING"

These → Bryant Heater and Motor Control Switches ↘

BRYANT
SUPERIOR WIRING DEVICES



HEATER SWITCH
No. 6279
[Less cover]

A few of over three thousand "Superior Wiring Devices" listed in our Catalog

"New Wrinkle" Sockets
"Perkins" Switches
"Pyrotite" Fuse Plugs
"Uno" Shade-Holders
"Wrinklet" Sockets
"Yankee" Switches
"Spartan" Receptacles
"Titan" Sockets
"Brylock" Locking feature for Lamp Sockets
"D.D." [Disappearing Door] Receptacles and Plugs
"Dubl-Duty" Two-way Sockets
"Elexit" Devices
"Junior" Rosettes
"Perma" Finish for Flush Plates
"Spar-Tap" Two-way Sockets
"Undark" Luminous Pendants and Inserts
"Glo-Guide" Luminous Switches
"De Luxe" Wood Inlaid Flush Plates
"Templus" Composition Plates, Plugs, Switch and Receptacle Bodies
"Dugle" Two Circuit Single Gang Flush Switches
"Trigle" Three Circuit Single Gang Flush Switches
"Ripple" Attachment Plug Caps

are of interest to manufacturers of electric ranges, water heaters, table stoves, etc., and to the builders of motor driven machinery requiring positive motor control.

HEATER SWITCH No. 6279

.... a single pole, series parallel three-heat-and-off switch of reversible action. Built to the rigid Bryant standards, it will give positive heat control over a long period of service and resistance to possible over loads. No. 6279 is of standard Bryant design though special types are provided to meet unusual needs.

EXPULSION TYPE SURFACE SWITCH
No. 782

.... this new switch was designed especially for inductive loads in 3-phase motor control up to 2-h. p.

An unusually well made switch of great strength and positive action. Two covers are available -- pressed steel or cast iron - each dust proof.

In factories, textile and flour mills, this switch will prove its super-qualities.

EXPULSION TYPE SURFACE SWITCH
No. 732 for Motor Control
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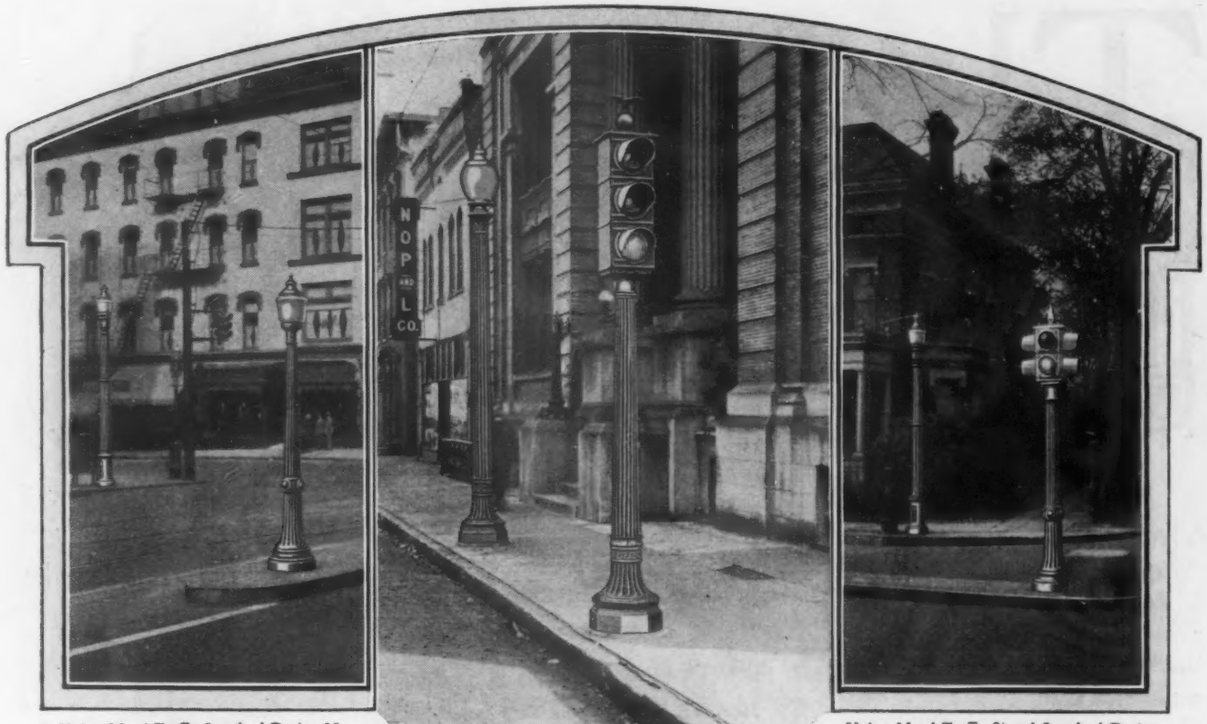
A SUPERIOR WIRING DEVICE *for* EVERY ELECTRICAL NEED



Union Metal Traffic Standard Design No. 3433 in use in Buffalo. N. Y.

Union Metal Traffic Signal Standard Design No. 3400 as used in Canton, Ohio

Union Metal Traffic Signal Standard Design No. 3430 as used in Buffalo, N. Y.

Bring Safety to Your City

In these days of unprecedented motor traffic, Union Metal Standards for safety zones and signal lights point the way for increased safety. There is no danger of confusion with an "Eye-Level" Union Metal Standard on each corner—no craning of necks while watching for the light to change—instead, complete visibility from all angles.

Adequate traffic protection is essential, but the modern city obtains beauty, too, with Union Metal Standards—standards specially designed to harmonize with well-planned streets. Their clean-cut, artistic beauty adds to the appearance of any thoroughfare and identifies that city as being progressive and alert to the latest achievements.

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If you are interested in civic improvements you will be interested in Union Metal Traffic Standards. Write for the complete story.

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Chattanooga Savings Bank & Trust Company, Chattanooga, Tenn. R. A. Hunt & Company, Architects. Wired 100% with PARANITE

PARANITE for Permanence

NO MATTER which way you turn—South, North, East, West—you'll find architects, builders and contractors agreeing that prudence points to Paranite for *permanence*. . . . All over the country, fine new buildings, like this Chattanooga structure, are wired *exclusively* with PARANITE. For 38 years it has stood the test. And into each roll goes *something* that only *experience* can give.

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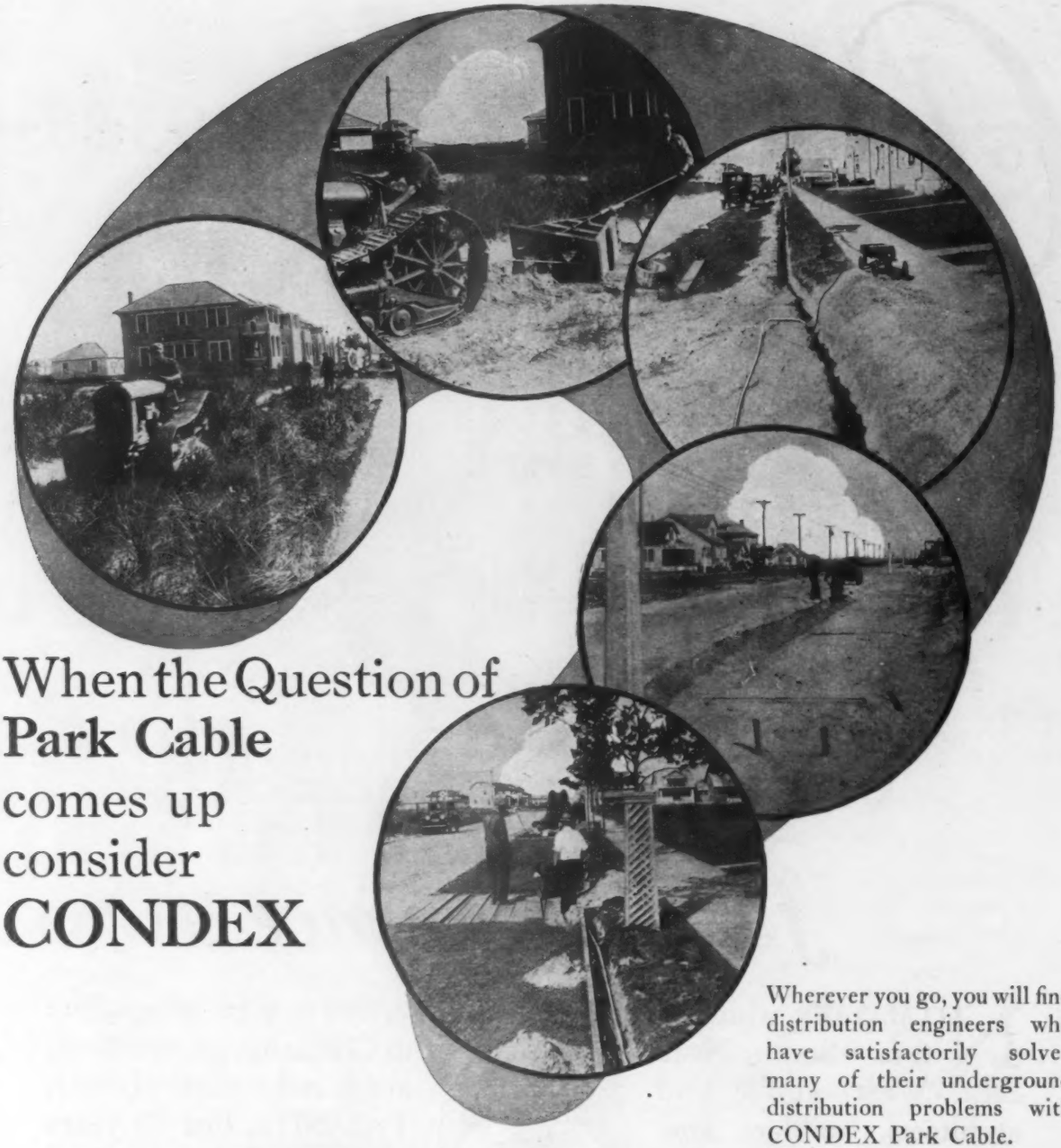
IF IT'S PARANITE IT'S RIGHT



When the Question of **Park Cable** comes up consider CONDEX

Wherever you go, you will find distribution engineers who have satisfactorily solved many of their underground distribution problems with CONDEX Park Cable.

The speed with which CONDEX can be laid and the low cost of installation are features. A glance at the pictures shows how easy it is. Once placed underground, CONDEX is good for years. Send for a sample piece of CONDEX and quotations.

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YOU are taking part in this battle... science against sludge. Let us supply you with a modern scientific weapon that will better enable you to win an easy victory.

Unacal Turbine Oil, experts say, is the most effective lubricant yet found to minimize sludge accumulation. It's the lubricant that you've been waiting for.

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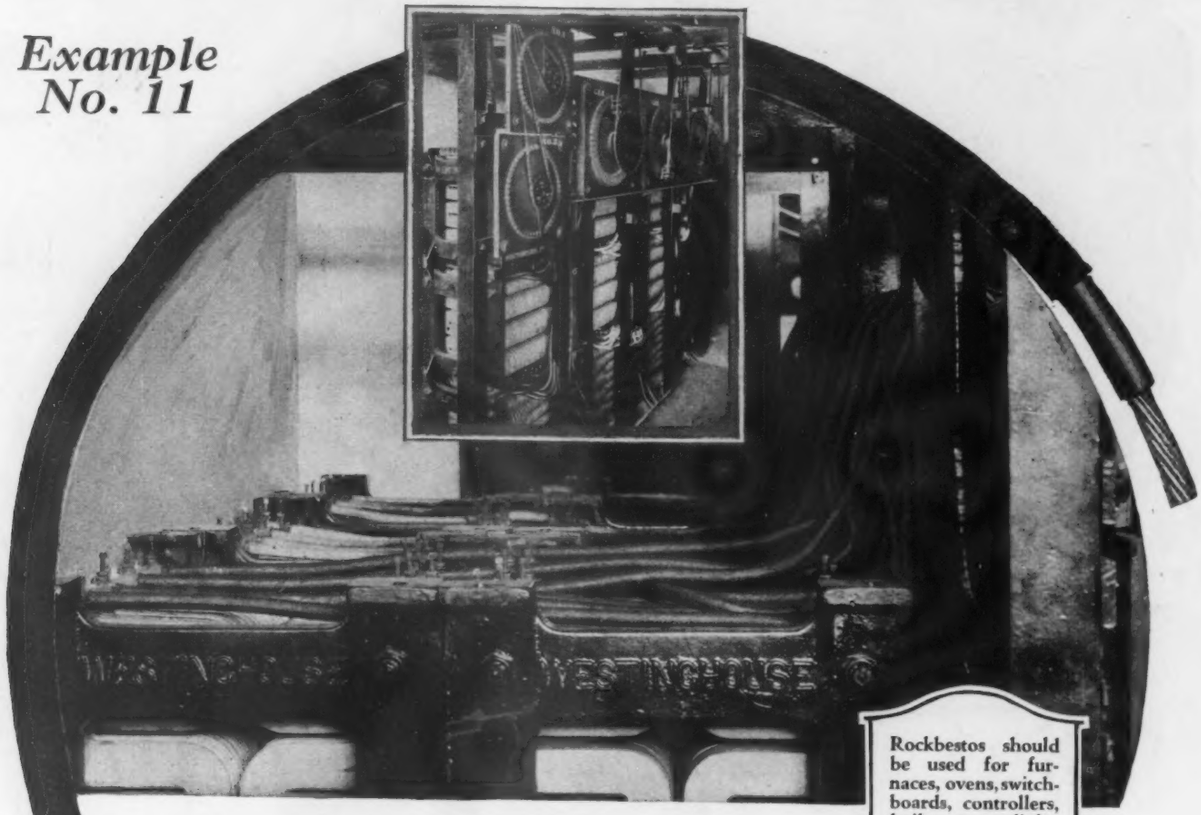
WHY WHEN and WHERE TO USE ROCKBESTOS —the asbestos covered wire

Example No. 11



Rockbestos should be used for furnaces, ovens, switchboards, controllers, boiler room lighting circuits, motor leads and internal connections — in fact, wherever wire encounters heat.

Where Heat Would Ruin Ordinary Insulation

Here we show Rockbestos wires running along the top of a generator rheostat from control head-plate to various sections. This particular installation is at the Little Falls Station of the Utica Gas and Electric Co., Utica, N. Y. Rockbestos insulation is proof against extreme heat that is apt to be generated. Ordinary insulation would break down or disintegrate. And this public utility company has safeguarded its equipment with Rockbestos.

Rockbestos—the asbestos covered wire—is the wire to use where extreme heat conditions are present.

Our engineers will gladly give you any desired information that will help on special applications.

ROCKBESTOS PRODUCTS
CORPORATION
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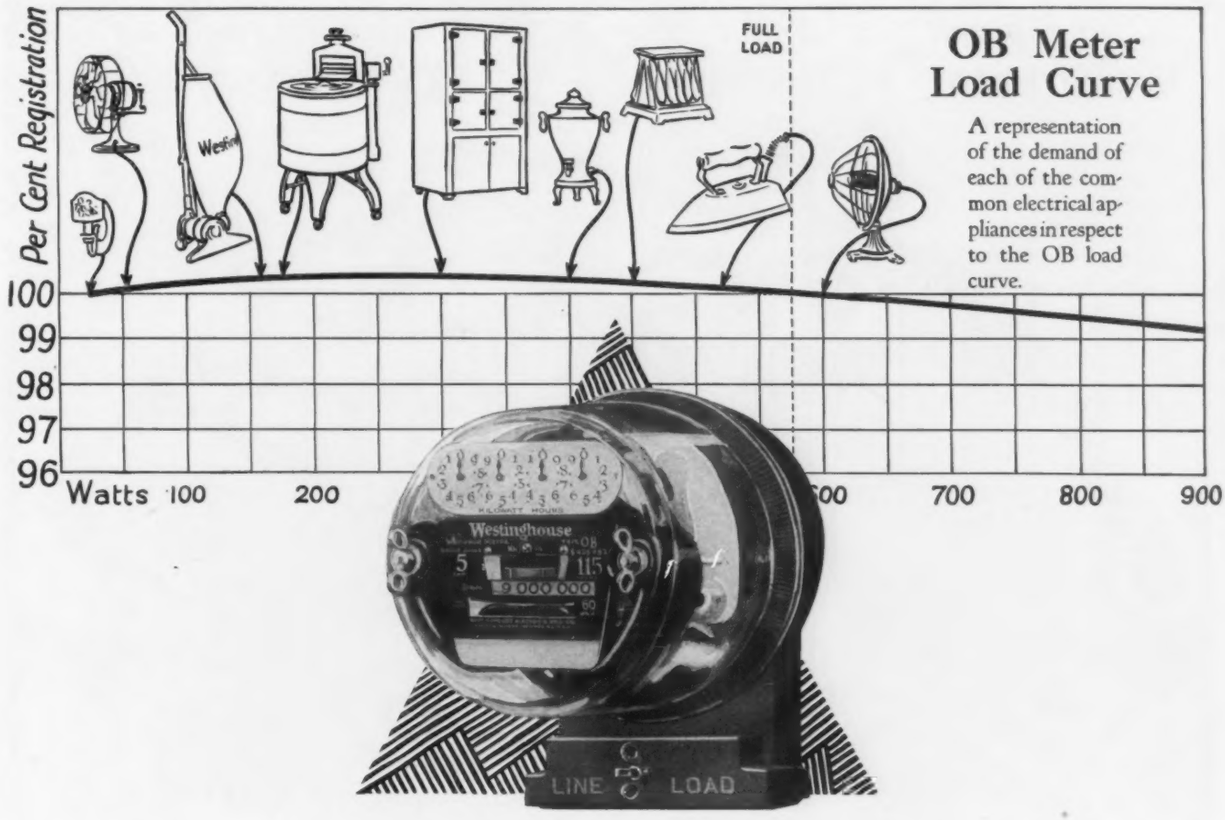
OVERALL ACCURACY



Consider These Statistics and OB Overall Accuracy

RECENT surveys have shown that the average demand of all classes of residence consumers is somewhere between one-quarter and one-half full load on the 5-ampere meter. Furthermore, the statistics gathered have revealed the fact that although the modern home uses more electrical appliances than heretofore, the simultaneous use of two or more appliances seldom occurs. Therefore, the system peak load has not been increased materially, but rather the long hour use of electricity has been increased.

Westinghouse OB meters, with their extreme light-load accuracy, as well as overall accuracy, most accurately register all classes of residence loads.

The meter specialist in the district office nearest you is at your service.

For the routine testing of watthour meters, use the Westinghouse OB Portable Standard, but use the Westinghouse precision wattmeter and a stop watch to definitely establish each point on any watthour meter accuracy curve.

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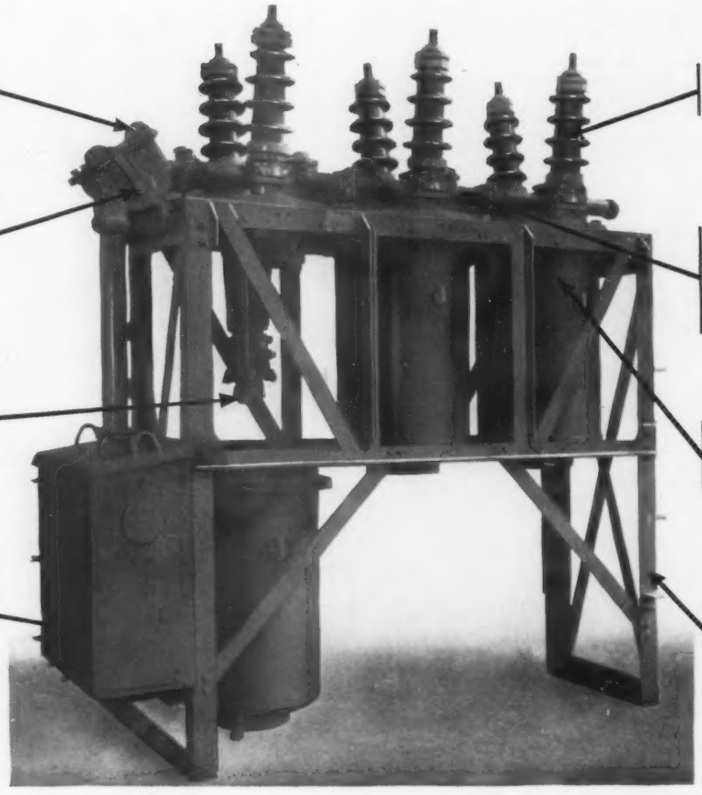
Double Bell Crank Housing protects mechanism from gas and oil.
Open or Closed Position positively and plainly indicated.
Arcing Contacts of high-speed type, minimize arcing, oil deterioration, pressure, and the severity of duty on the breaker structure.
Mechanism mechanically trip-free in all positions. Prevents pumping, gives greater safety to operator when hand-closing.
Condenser-Type Bushings give maximum insulation and strength.
Shaft-Operated Toggle Mechanism prevents propagation of gases and oil from one pole to another and from the mechanism housing.
Cylindrical Tanks of formed, welded, boiler plate fitting into oil-tight grooves in top.
Welded Steel Frame gives rigid support and easy access to breaker.

A New Oil Circuit Breaker Type O-241

THIS latest type of Westinghouse breaker is designed for 600, 1200 and 2000 amperes at 15,000 volts and 600 and 1200 amperes at 37,000 volts.

Where necessary, shafts and bearings are of a non-freezing and non-corrosive combination.

The hydraulic bumpers provide an oil cushion on the opening stroke. They do not retard the opening speed of the contacts.

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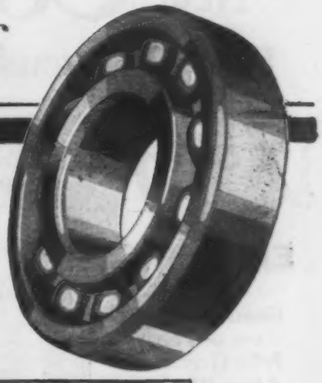
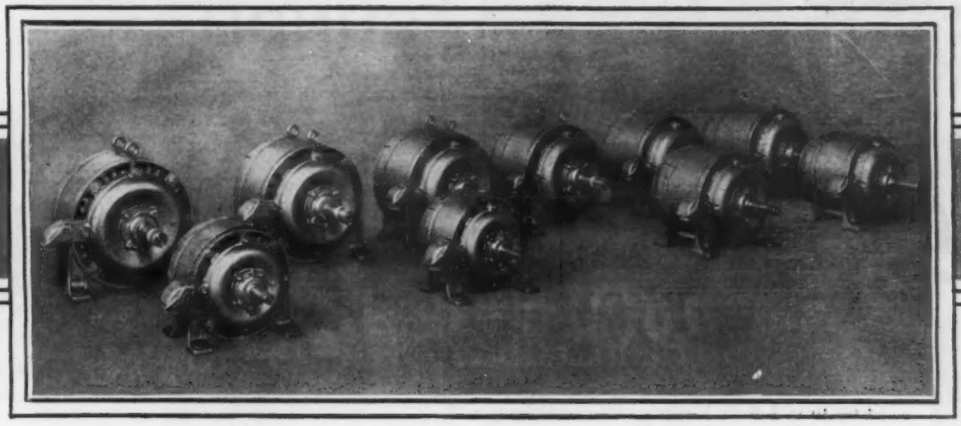
More than Fifty Manufacturers of General Purpose Motors Use Ball Bearings





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WAGNER general purpose electric motors are obtainable with ball bearings as standard or optional equipment.

Noticeable in the 10 Wagner fan-cooled motors shown is a compactness of construction which can be best obtained with ball bearings. These 7 1-2, 10 and 15 h.p. motors have greatly reduced overall dimensions and, therefore, economize valuable space.

While compactness is an essential detail of modern design, it is but one of the many advantages and economies obtainable by the use of New Departures.

Long life, permanent retention of original accuracy, ease and economy of maintenance, together with many others are explained in two booklets published by the Engineering Department. They are "Cutting Your Costs" and "Booklet K". Yours for the asking. Write now.

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In the New **Colors!**

Every Housewife Adores

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Beautiful Pastels
on old ivory
Nile Green
Alice Blue
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Oriental Yellow

This L&H Electrics Range has one-piece, rust-proof, porcelain enameled oven; angle iron base, boltless, cast tops and legs. Drawer type, porcelain enameled drip pan with glass handle. The new L&H Electrics automatic temperature control—direct action—noiseless. Operates on either D. C. or A. C.; not affected by frequency or voltage changes. Can be equipped with L&H Electrics Time Control.

L&H ELECTRICS
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Storage Type

The new L&H Electrics Water Heaters provide constant, dependable hot water supply for all purposes.

Simple, compact, automatic, durably built and easily installed. In 10 gal. or 25 gal. capacity. Heater Unit easily removed for cleaning without disturbing plumbing or electrical connections. For A.C. or Direct current—unaffected by frequency or voltage changes.

Finished in Nile Green (baked Japan)—ideal for kitchen installation.

L&H Electrics Appliances include Ranges, Hot Plates, Urn Heaters, Waffle Irons, Toasters, Table Stoves, Irons, Heating Pads, Curling Irons, Heaters, Portable and Flush Type Air Heaters and Water Heaters. For profit facts regarding the full line, use the information coupon below or write.

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Electric Motor Control Apparatus

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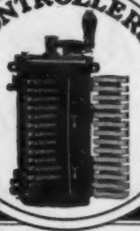

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Meter and Relay Test Switch

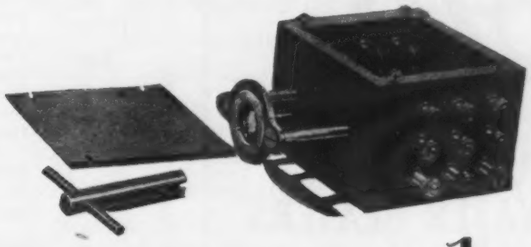
This is cheap insurance against accident to the meter and relay tester.

The Elpeco R. T. Switch installed on the *front of the switchboard*, where all tests are made, keeps the operator away from live busses — oil switches — disconnects and other hazards.

Then, there is no chance of incorrectly reconnecting the current transformer leads—nor can the operator leave a circuit open. After the operator opens the circuit, he cannot pull the "switch key" out without first closing the circuit—so the operation of test on one set of Relays or Meters is completed before a test on another set is started.

A Bulletin with many different wiring diagrams — method of operation—details of construction will be mailed to you on request and our nearest District Manager will be pleased to go over with you your next switchboard layout and show you the advantage of this device.

Your station operator can make all the necessary tests on your relays and meters. This switch does not require an expert.



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This recent installation is a four-motor control job at the Long Beach No. 2 Steam Plant of the Southern California Edison Company.

For many years "Circle T" switches have proved the ultimate in safety and dependability, and it costs no more to be "Circle T" protected. Ask your contractor or jobber.

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Capacity 21 Gallon

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A.C. single and polyphase watthour Meters (1, 2, 3 and 5 elements) = Reactive Component Meters = Kva.hr. Meters = Switchboard Meters = Maximum Demand Instruments = The **Maxigraph** = Two and Three Rate Meters = Differential Meters = Prepayment Meters = etc., etc. = Time Switches = Remote Control Switches = Contact Clocks = Instruments Transformers = **Multi Range Precision Current Transformers** = D.C. Watthour Meters = Ampere hour Meters = etc., etc. = **Bulletins are available.**

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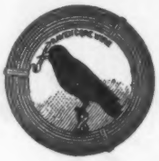

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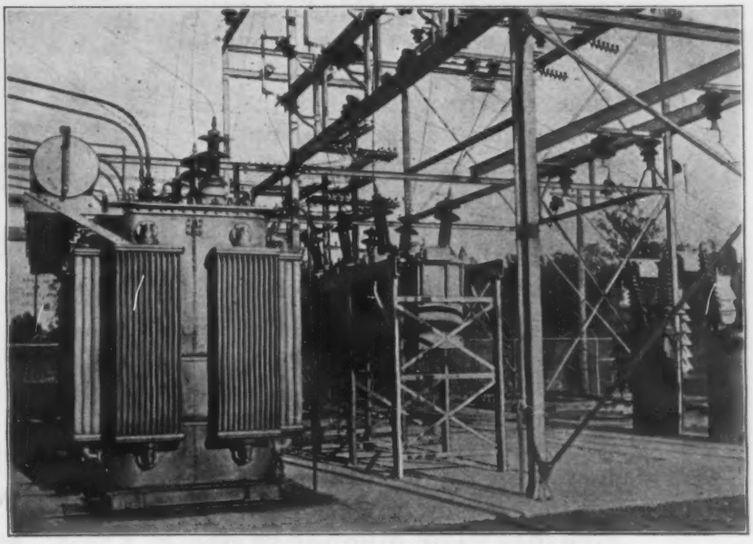
MOTORS... Single-phase, Polyphase and Fynn-Weichsel Motors TRANSFORMERS... Power, Distribution and Instrument
FANS... Desk, Wall and Ceiling types

These three 1667 KVA, oil filled, steel case Wagner Power Transformers... 72,500 volts to 2300/6900/11900 volts, 60 cycle, single-phase are operating on the lines of a well known public service company.



Specify Wagner TRANSFORMERS...

FOR DEPENDABILITY... Extra heavy insulation on end turns; connection of taps to the center of the winding, and not at the end; extra heavy high voltage bushings; carefully selected materials; and other refinements of design assure dependable service on the part of Wagner Transformers.

FOR RUGGEDNESS... Heavy case made of copper-bearing, rust-resisting steel; structural steel frame work supporting assembled core and coils;... construction features like these assure strength to withstand rough handling.

FOR HONESTY OF MANUFACTURE... Wagner is noted for the honesty of its manufacture. Only such material as is specified by its engineers and passed by its inspection department is employed in the construction of Wagner Transformers. Not how long it takes to assemble a transformer, not how cheaply it can be built... but how good it can be made, guides Wagner practice.

Specify Wagner Transformers.

WAGNER ELECTRIC CORPORATION... 6400 Plymouth Avenue... St. Louis, U. S. A.

77-6737-16

Proved by fire

To THE eye, the carbon brush seems a simple thing. Just a block of carbon ground down to the right shape and size, sometimes with a shunt attached. From mere inspection, no one would suspect how complicated its history really is. A perfectly operating brush may, at the most, suggest that a high degree of technical skill was involved in the selection of that particular brush for the work it has to do.

Yet as a matter of fact that technical skill goes far back of mere selection. No less than 36 major operations are necessary to make National Pyramid Brushes. The number varies somewhat with different types of brushes, and may go as high as 49, from the burning of the oil into lampblack to the last test and inspection of the brush.

Probably the most unexpected manufacturing process is that of baking. There are two baking operations, totaling 60 to 66 days in ovens and furnaces of high temperatures. The simple-looking carbon brush is in fact as highly developed technically as are the machines on which it is used.

NCC

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide UCC *and Carbon Corporation*

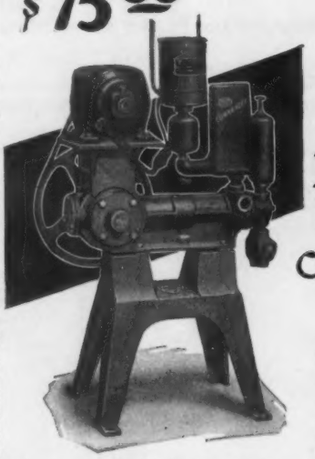
Carbon Sales Division

Cleveland, Ohio — SILVER STRAND CABLE TRADE MARK REGISTERED — San Francisco, Cal.

Branch Office and Factory

San Francisco, Cal., 599 8th St. Phone: Park 8800

$75.00



The PAUL COMMANDER DIRECT SERVICE WATER SYSTEM

Big Capacity Low Price! *Automatic!*

THIS compact little outfit has a capacity of 215 gallons per hour, the highest of any pump of its type at anywhere near the price, quality being equal. Has the new Paul Non-pulsating device [patent applied for] which is especially designed to eliminate entirely the pulsating action of the system, insuring quiet operation. It is fully automatic and whenever a faucet anywhere in the house is opened the pump starts and delivers water under pressure direct from the source. When the faucet is closed the pump stops—no attention—no bother. It will pump from cistern, shallow well, lake, spring or stream,—wherever water supply is not more than 22 feet below pump Here's the ideal water system for the small suburban and country home, and it lists for just $75.00.

Write for Bulletin and full details.

FORT WAYNE ENGINEERING & MFG. COMPANY

PACIFIC COAST BRANCH 211 Oak St., Portland, Ore. FORT WAYNE, IND.

Circulation Water Heater—complete, Price $50.00

AIR ELECTRIC WATER HEATERS

A Complete Quality Line at New Low Prices

Made by

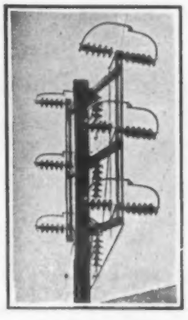
APEX MANUFACTURING CO.

OAKLAND, CALIF.

Northern California Distributors

SANDOVAL SALES COMPANY

115 Jessie St., San Francisco



FOR SECTIONALIZING—Specify K-P-F Switches. Manufactured for any voltage. On large hydro-electric developments you will find extensive use of K-P-F high tension switches. They were developed to meet the demand for simple inexpensive switches which could be installed in the circuit at a minimum cost and with little interruption on the line.

Each unit is self-contained. Switches are shipped complete, ready to bolt to cross-arm. Also suitable for steel tower mounting. Write for bulletin 105.

K-P-F ELECTRICCO.

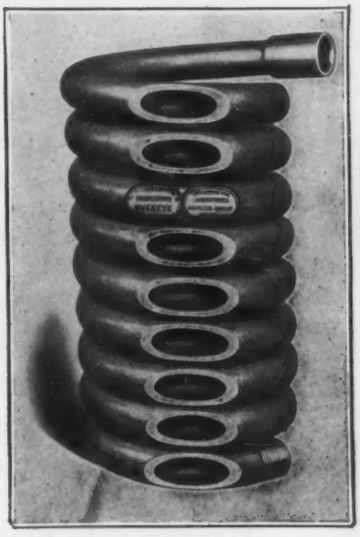
855-859 Howard St., San Francisco

Youngstown Buckeye Conduit

Clean Cut Threads

Interior As Smooth As Glass

Easy To Work And Easy To Bend



More Youngstown Buckeye Conduit Is Sold Than Any Other Make

YOUNGSTOWN SHEET AND TUBE COMPANY

Youngstown, Ohio

Collyer Wires and Cables

For Every Useful Purpose

Rubber Covered Wires and Cables
Weatherproof Wires and Cables
Slow Burning Wires and Cables
Annunciator Wires
Office Wires
Fixture Wires
Telephone Wires
Silk Covered Cords
Rubber Covered Cords
Cotton Covered Cords
Heater Cords
Reinforced Cords

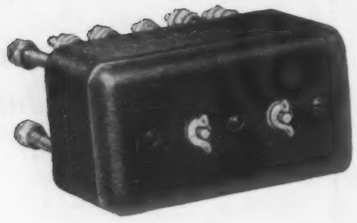
COLLYER INSULATED WIRE COMPANY

Pawtucket, R. I.

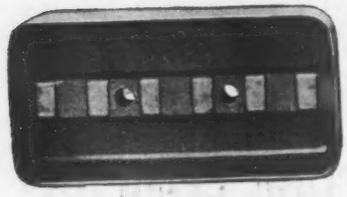
ALLIED INDUSTRIES, INC.

San Francisco Los Angeles Oakland Portland Seattle

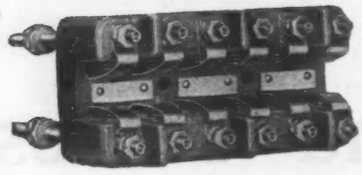
These devices provide



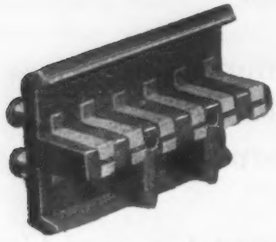
A 6-pole Type PK-1 block with cover in place. These front-of-board devices require very little space.



Inside of cover, showing bridging contacts which make through connections between the block contacts when the cover is in place.



Block with cover removed. This isolates the device and short-circuits the current-transformer secondaries.



The Type PK-1 test plug is provided with test links and terminal studs so that any type of connections may be obtained.

The plug when inserted in block establishes through contacts for testing either in circuit or through a separate power source.

GENERAL

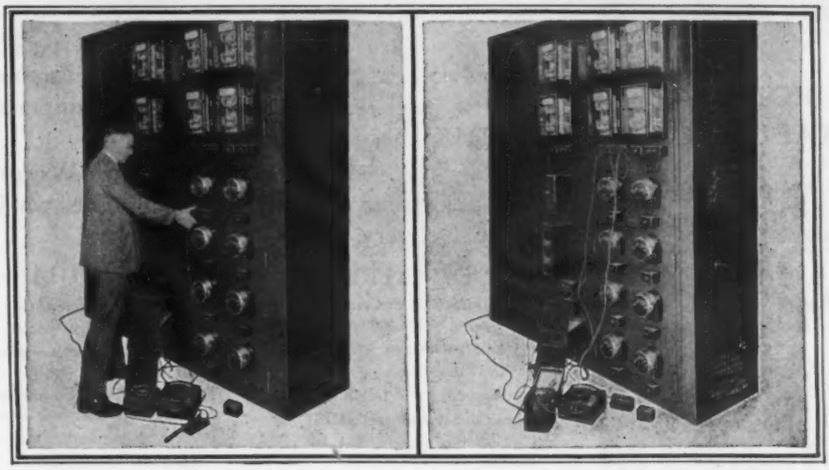
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

complete testing facilities

for relays, meters, and instruments

Type PK-1 test blocks and plugs fully meet modern requirements for complete, safe, testing of relays, meters, and instruments. These devices have been developed after exhaustive investigation of up-to-date testing practices. They permit the connection of devices in any desired order in the current-transformer circuit, the testing of relays without disconnecting meters and instruments from service and vice versa, and the testing of single-phase, overcurrent relays in one phase without disturbing the others, thereby assuring partial circuit protection during the testing period.

These test blocks and plugs which are built in 4- and 6- pole units, combine the advantages of test switches and test studs and links; they practically reduce check testing to a matter of mistake-proof routine requiring very little time, and so providing substantial economies.



Testing Relays *Testing Meters*

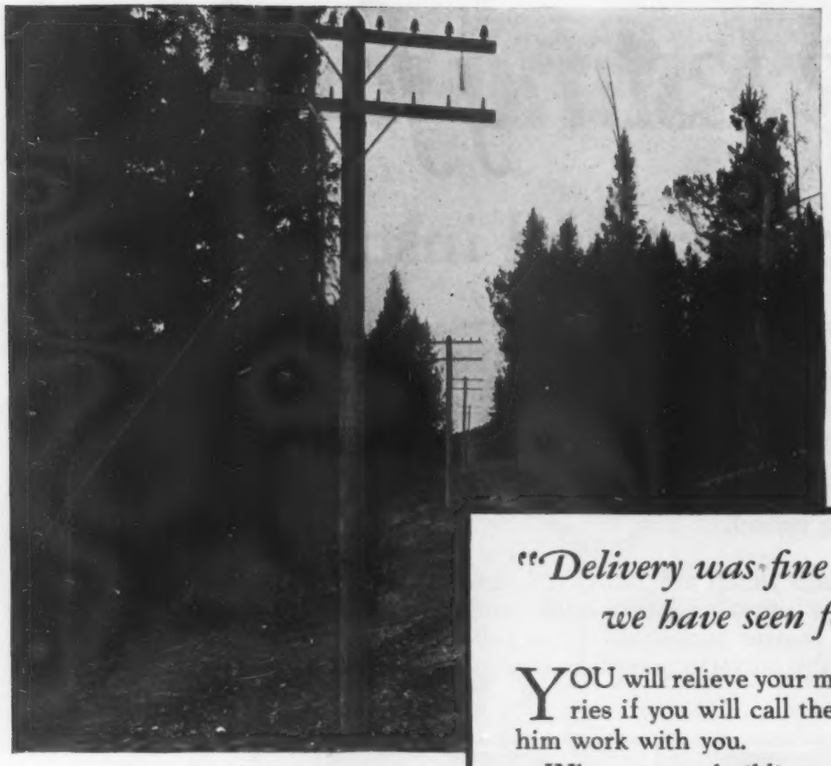
Relays and meters can be tested with the line in service without the hazard of accidentally tripping the circuit-interrupting device and without removing protection from any phase except the one under test. The time required for testing each phase is short.

The Type PK-1 testing devices can be applied to any type of switchboard for use with any standard make of instruments, meters, and relays. Testing can be performed by attaching the test clips to the front studs of the test block.

500-22

ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES



"We received the car of Idaho Red Cedar Poles ordered of you recently.

"Delivery was fine and the poles were the best lot we have seen for some time.

"When in need of more poles we will certainly keep your company in mind."

—From a Wisconsin customer.

Before you buy POLES—
see WEYERHAEUSER

*"Delivery was fine * * * best lot of poles we have seen for a long time"*

YOU will relieve your mind of a good many pole worries if you will call the Weyerhaeuser man and let him work with you.

What we are building up here is a responsible and permanent Pole Service for *permanent customers.* We have the poles—the experience—the equipment—the intention to make good.

Make us prove it—a trial order. Call the Weyerhaeuser man. He's easy to reach. When he promises you Quality, Service, Delivery, *this* is what he means:

QUALITY

Immense forests of fine straight Idaho Red Cedar Pole Timber.
Only experienced pole men employed.
Only "live" trees used.
Expert seasoning and treating.
Frequent and rigid inspection.
Expert storing and loading to avoid damage.

HANDLING

Five modern storage yards.
Large and complete stocks.
Immediate shipments—practically any quantity of any size.
Prompt advice on car numbers, routing and probable arrival date.
Prompt tracing and advices.
Responsible transaction throughout.

WEYERHAEUSER SALES COMPANY

Distributors of WEYERHAEUSER FOREST PRODUCTS
General Office: SPOKANE, WASHINGTON

Branch Offices:

MINNEAPOLIS, 806 Plymouth Bldg. — ST. PAUL, 2563 Franklin Ave. — CHICAGO, 208 So. La Salle St.
KANSAS CITY, 1418 R. A. Long Bldg. — TOLEDO, 1313 Second Nat. Bk. Bldg. — PITTSBURGH, 2401 First Nat. Bk. Bldg.
PHILADELPHIA, 1600 Arch Street — NEW YORK, 285 Madison Ave. — PORT NEWARK, P. O. Drawer 629, Newark, N. J.

R. L. Bayne, Spokane Office, Manager of Cedar Pole Service

Selling Representative, California, Nevada and Arizona:
A. R. EDWARDS & CO., Mills Bldg., San Francisco, Calif.

WEYERHAEUSER Idaho Red Cedar Poles

THEY GRIP—THEY HOLD

Your Electrical Distributer Can Supply You With Matthews Specialties

SIMPLY start them into the ground; then screw them into undisturbed soil. Simple, easy, economical. They bite into the ground with a bull dog grip. Place them under strain and they hold. This is due to the helical design of the anchor head.

When the anchor is installed and placed under strain, lines of force radiating at a 45-degree angle to the head encompass a cone of undisturbed earth, the weight of which is concentrated in the anchor head. Even in treacherous soil they hold, demonstrating why Matthews Scrulix Anchors are preferred for difficult installations.

Write for Bulletin 802 describing these anchors in detail.

W. N. MATTHEWS CORPORATION
Engineers and Manufacturers
3708 Forest Park Blvd., St. Louis, U. S. A.
Offices in All Principal Cities

MATTHEWS
SCRULIX ANCHORS
Look for SCRULIX *on the Helix*

147

WORKMANSHIP

INTERNATIONAL standards of workmanship are definitely designed and have been developed to produce only quality poles—which have proven by service records to have great strength—great durability—and which have already given 28 years of service and are still in excellent condition.

Here you see the results of ***International*** skilled workmanship. The most exacting standards of manufacture and inspection prevail in cutting, peeling, seasoning, framing and treatment.

The importance of the smallest detail and the precautions taken to render service can be appreciated by every engineer who investigates ***International*** methods.

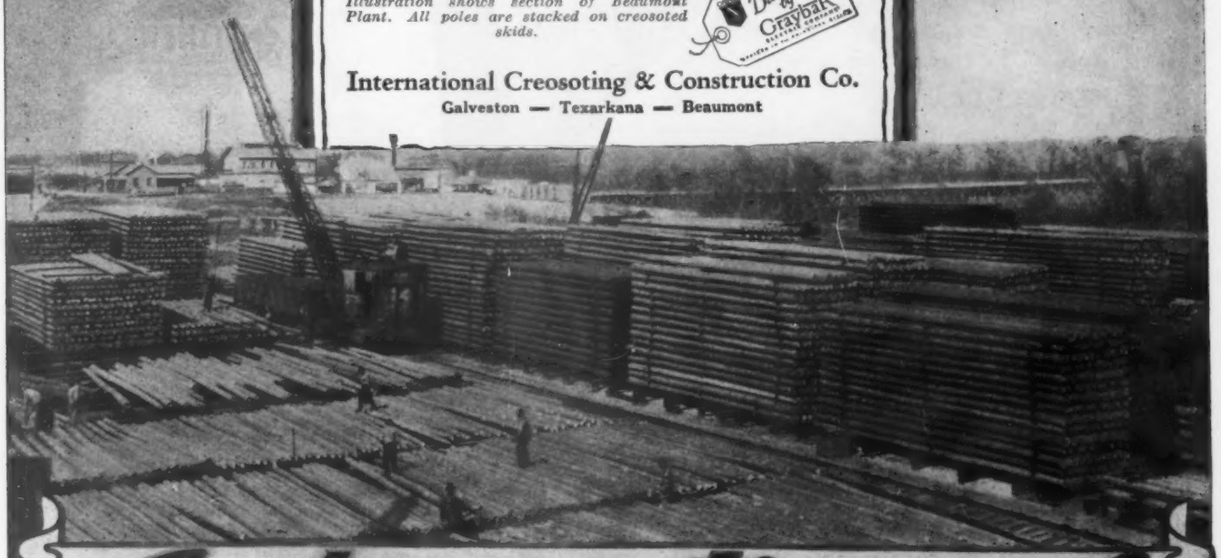
Each pole is of the highest quality—is absolutely dependable—and is backed by our 50 year old established and highly valued reputation.

Illustration shows section of Beaumont Plant. All poles are stacked on creosoted skids.

Distributed by Crayba R

International Creosoting & Construction Co.

Galveston — Texarkana — Beaumont



International Creosoted Yellow Pine Poles

There are Hundreds and Hundreds of Miles of Thomas-Hewlett Construction

IT hasn't been so very many years ago that seeing a line strung on Hewlett insulators was something that set engineers to talking. Not because they were Hewlett, but suspension construction only dates back to the birth of the Hewlett and in those days was considered quite a novelty.

But not so today. In this age you can travel hundreds and hundreds of miles in most any direction and rarely will you fail to find active evidence of Thomas-Hewletts in service on the country's most important power systems. Some of these installations have only been up from five to ten years, but others have carried on for fifteen or twenty years or more, quite an enviable record of achievement when you consider that all have functioned unfailingly.

Unquestionably, there must be something more than a promise to Thomas-Hewlett Insulators. At least their reputation based on past performance insures *Uninterrupted Line Service*. . . . . .

Est. 1873 — THE R. THOMAS & SONS CO. — Inc. 1892

Lisbon, Ohio

NEW YORK BOSTON CHICAGO LONDON

GRAYBAR ELECTRIC CO., Inc., on the Pacific Coast

NORTHERN ELECTRIC CO., Ltd., in Canada

Thomas LINK TYPE Hewlett

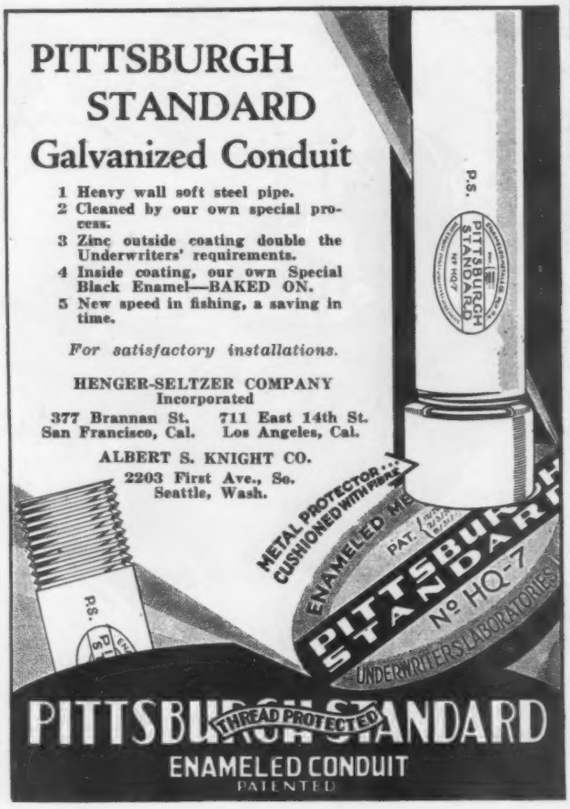
PITTSBURGH STANDARD
Galvanized Conduit

1 Heavy wall soft steel pipe.
2 Cleaned by our own special process.
3 Zinc outside coating double the Underwriters' requirements.
4 Inside coating, our own Special Black Enamel—BAKED ON.
5 New speed in fishing, a saving in time.

For satisfactory installations.

HENGER-SELTZER COMPANY
Incorporated
377 Brannan St. San Francisco, Cal.
711 East 14th St. Los Angeles, Cal.

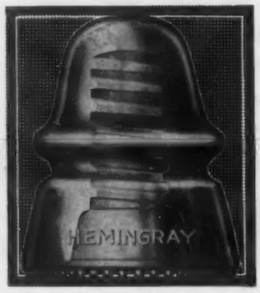
ALBERT S. KNIGHT CO.
2203 First Ave., So.
Seattle, Wash.



PITTSBURGH STANDARD
THREAD PROTECTED
ENAMELED CONDUIT
PATENTED

HEMINGRAY
made in sizes up to 15,000 *volts*

EST. 1848 INC. 1870



For medium voltage lines
Insulate with Glass
Advantages!

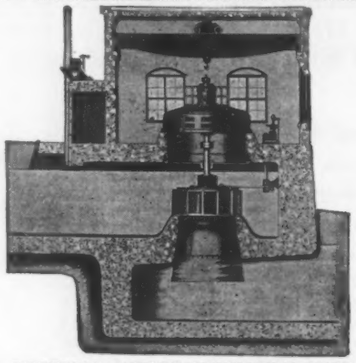
(1) Transparency
Exposes internal defects

(2) Non-Porosity
Eliminates Moisture Absorption
Sustains dielectric strength
Prevents deterioration

(3) Homogenity
Insures uniform insulating properties throughout each insulator.

Up to 15,000 standardize on Glass

HEMINGRAY GLASS CO.
General Office and Factory Muncie, Ind.



VERTICAL DIRECT CONNECTED UNIT

TURBINE WATERWHEELS **LEFFEL** TURBINE WATERWHEELS

"A RECORD WE ARE PROUD OF"

66 Years' experience designing and building thousands of Leffel turbine water wheels surely is a recommendation worthy of serious consideration.

The dependability of Leffel turbines is proven by their continued satisfactory performance under heavy duty conditions and exacting requirements.

LET OUR ENGINEERS SHOW YOU WHAT WE CAN DO

THE JAMES LEFFEL & CO., SPRINGFIELD, OHIO

BRANCH OFFICES

New York, N. Y.....39 Cortlandt Street
Boston, Mass.....80 Boylston Street
Atlanta, Ga.....4th Nat'l Bank Bldg.
Minneapolis, Minn.....Plymouth Bldg.
Lancaster, Pa.....Woolworth Bldg.
Wm. Hamilton, Ltd., Peterborough, Ont., Can.

Armored CABLE and FLEXIBLE STEEL CONDUIT		Galvanized and enameled RIGID STEEL CONDUIT
Rubber-covered and lead-encased WIRE	*TRIANGLE ARMORED CABLE TOOL*	Non-Metallic flexible CONDUIT and SHEATHED CABLE

TRIANGLE CONDUIT CO., Inc.

General Offices: Dry Harbor Road and Cooper Ave., Brooklyn, N. Y.
Factories: Brooklyn—Chicago—Butler, Pa.
Western Offices: Los Angeles, San Francisco, Seattle

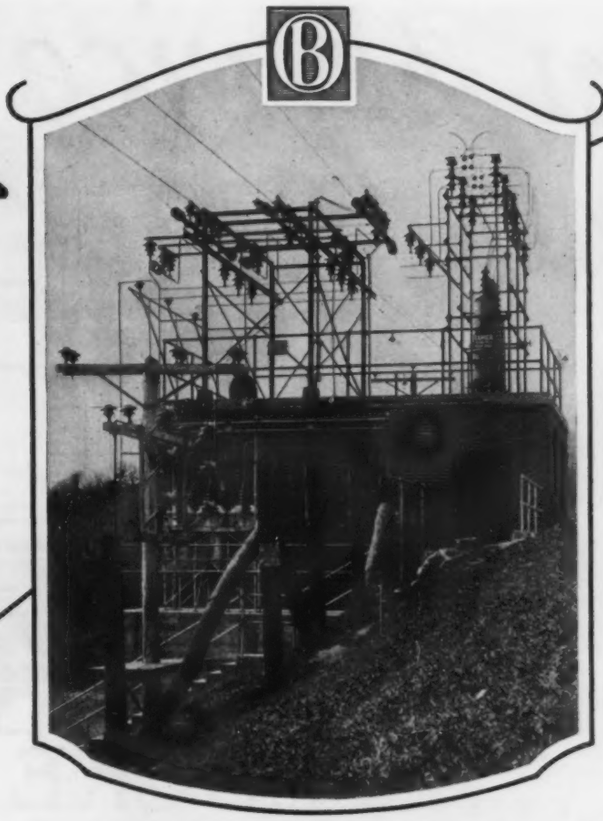
Quimby Screw Pumps
THE ONLY TWO MOVING PARTS

Two moving parts. No valves. No end thrust.
In all capacities and sizes.

Fuel Oil	Soap
Water	Molasses
Cold and Hot Oil	Sludges
Brine	Any Service

QUIMBY PUMP CO., INC. 342 Thomas St., Newark, N. J.
Western Representatives:
F. J. HEARTY & CO., 75 Fremont St., San Francisco
JOHN G. BELL CO., 712 E. 6th St., Los Angeles

No. 26024
Four-piece Switch and Bus Insulator, general rating 66-kv., single unit; 135-kv., two-unit stack; 200-kv., three-unit stack.



No. 26440
Three-piece Switch and Bus Insulator, general rating 44-66-kv., single unit; 110-kv. two-unit stack.

Where the Requirements Are Most Severe

TO design insulators for switch and bus installation is an involved matter—for such insulators must combine high mechanical reliability, maximum electrical efficiency, and long life. However, our unequalled facilities and our quantity production enable us to deliver these three important characteristics in O-B Switch and Bus Insulators.

To compensate for thermal stress—thus providing against cracking—and to obtain in assembly an extremely refined degree of accuracy—an essential of complete interchangeability—are very important considerations in switch and bus insulator selection. Consequently, the discussion of proposed installations with our engineers, *at the time when plans are being made,* is highly desirable.

Your consideration, or selection of O-B Insulators for switch or bus installation can well be influenced by their endorsement and use by leading power companies the world over.

San Francisco
215 Market St.

Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co., Limited
Niagara Falls, Canada

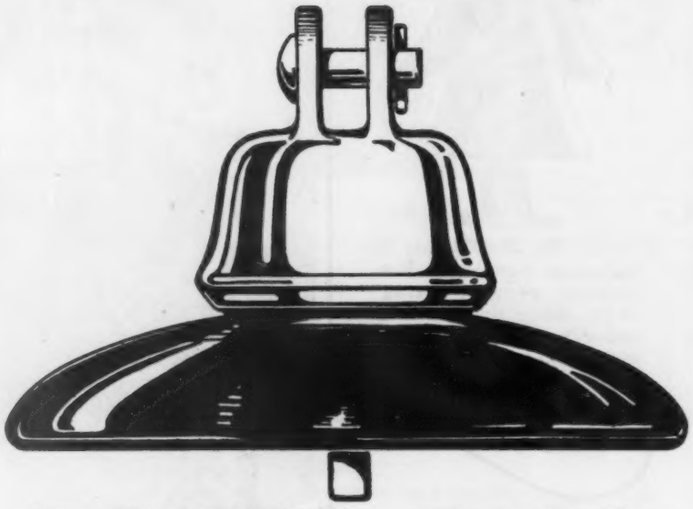
Los Angeles
417 So. Hill St.

Ohio Brass Co.

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH ST. LOUIS ATLANTA SAN FRANCISCO CLEVELAND LOS ANGELES

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES

When service counts



LOCKE 5800

The world's standard insulator. One operating company alone has almost a million of these in active satisfactory service.

You can recognize at a glance the advantages of this insulator.

The porcelain is the celebrated Locke Porcelain—the outcome of thirty-four years of research and experience.

The design has been proved correct both in the laboratory and in the field.

Electrically and mechanically it compares favorably with any insulator of the same type.

Made rugged to stand harder use than the average insulator, it saves time and money in construction.

The manufacture, assembly, packing and shipping leave nothing undone that can contribute to satisfactory performance.

When service counts specify Locke Porcelain Insulators.

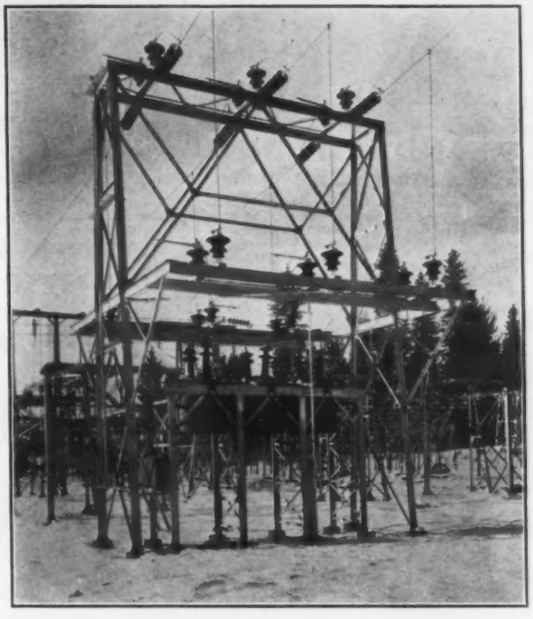
PACIFIC STATES ELECTRIC COMPANY

Distributors for the Pacific Coast

specify

LOCKE PORCELAIN INSULATORS

Above: General view of switching station at Prospect plant.



Below: 73-kv. oil circuit breaker and disconnecting switch structure.

AT PROSPECT PLANT

Simplicity, ruggedness of design and attractive appearance are combined with economy of erection and maintenance in the switching station of The California-Oregon Power Company at Prospect plant. All of the steel work was furnished by the Pacific Coast Steel Company.

PACIFIC COAST STEEL COMPANY

MANUFACTURERS OF

OPEN HEARTH STEEL

STRUCTURAL SHAPES MERCHANT AND REINFORCING BARS

TRANSMISSION TOWERS AND STRUCTURES

Gen'l Office: Hunter-Dulin Bldg., San Francisco Plants: San Francisco, Portland, Seattle

REMOVE HAZARDS TO LINEMEN

Use KEARNEY

Guy Wire Clips
Solderless Service Connectors
"No-Serve" Yokes

Guy Wire Clips

Kearney Guy Wire Clips are made of three materials—aluminum, copper, and galvanized iron.

Eliminate Serving of Strand

No extra tools are required to install Kearney Guy Wire Clips. As the illustration shows, simply slip the clip over one strand end and clamp the clip over the other end. Accomplish this operation with an ordinary pair of pliers or a pair of wire twisters if you prefer. These clips save the galvanizing on the strand and eliminate the dangerous method of serving strand ends.

Write for Bulletin 320

These three products, Kearney Guy Wire Clips, Solderless Service Connectors and "No-Serve" Yokes, remove hazards to linemen. The clips eliminate the dangerous method of serving strand ends, the connectors eliminate the use of hot solder and blow torch, and the "No-Serve" yokes also eliminate serving strand ends.

Other Products

Certified Malleable Screw Type Anchors, Hi-Tension Four-In-One Expansion Anchors, "Double Duty" Fuse and Disconnect Cutouts, Fuse Switches, Disconnecting Switches, Fuse Pullers, Expulsion Plug Cutouts, Sleeve Twisters with Interchangeable Dies, "Economy" Cable Clamps, Accessible Cable Joints for Underground work.

JAMES R. KEARNEY CORPORATION
4230 Clayton Avenue, ST. LOUIS, MO.

"No-Serve" Yokes

Kearney "No-Serve" Yokes are used for light and heavy strains. They have a distinct application for use in coupling strings of insulators.

Eliminate Soldering of Connections

Eight different sizes of Kearney Single Solderless Service Connectors and two sizes of Double Connectors are available. These connectors can't slacken off causing poor contact, because of the added tongue on the washer. The main and tap are clamped together in actual contact with each other. These connectors eliminate the use of solder and blow torch.

Write for Bulletin 310

SOLDERLESS SERVICE CONNECTORS

KEARNEY

OVERHEAD AND UNDERGROUND UTILITY EQUIPMENT

Factory Representatives: MAYDWELL & HARTZELL, INC., 158-168 Eleventh St., San Francisco; 455 Colyton St., Los Angeles

SMS Co

The operating and earning efficiency of water power installations depends primarily upon correct design to meet the conditions under which they must operate.

It has long been our policy to specialize exclusively in the producing of high grade water power equipment that cannot be surpassed in the perfection of operating efficiency.

Smith Hydraulic Turbines are the result of 50 years specialization in water power equipment.

Bulletin "H" sent on request.

S. MORGAN SMITH CO.
York, Pa.

461 Market St. San Francisco

WIREMOLD

ACCEPTED STANDARD FOR SURFACE WIRING

Sample and Catalogue upon request

THE WIREMOLD COMPANY
HARTFORD, CONN.

TECHNICAL BOOK SHOP

A service established to assist you in selecting the technical books best suited to your needs. If the books you need are not in stock, every effort will be made to procure them for you.

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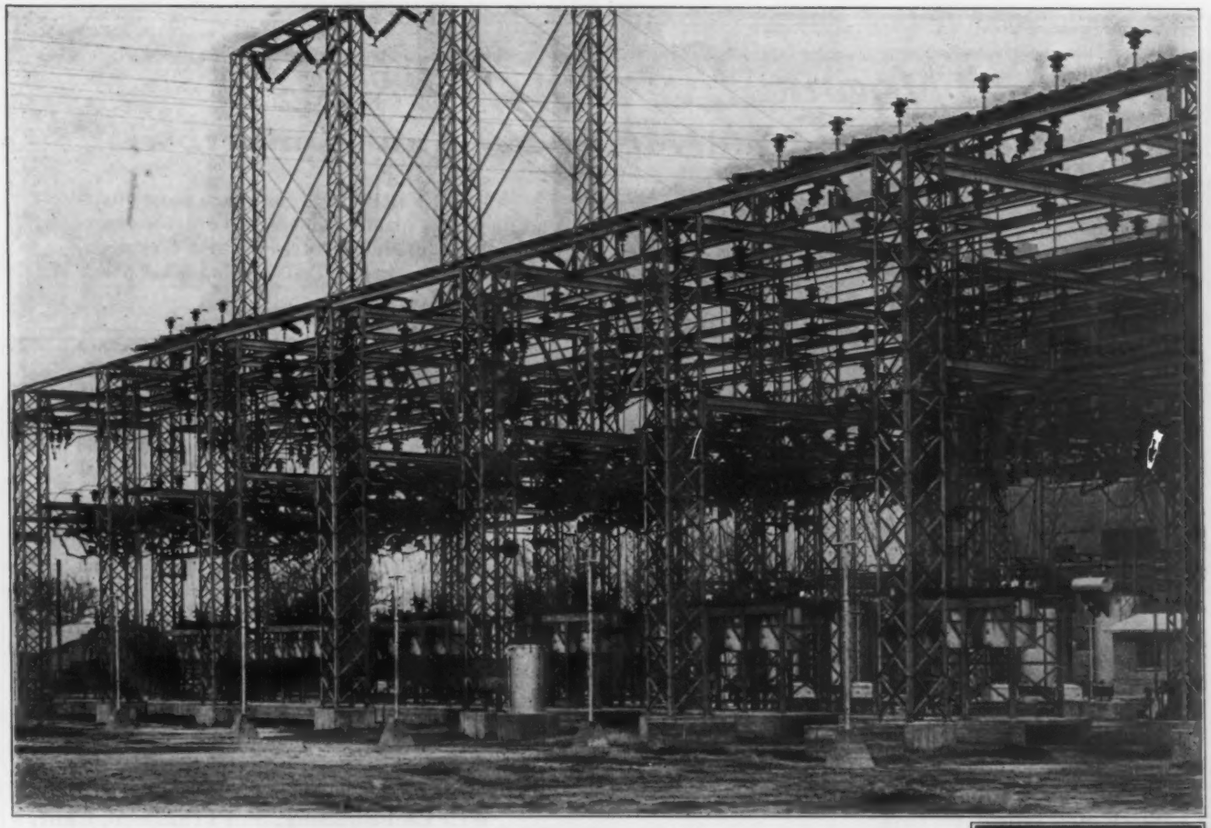
TECHNICAL BOOK SHOP
883 Mission Street, San Francisco



PACIFIC ELECTRIC ENGINEERING SERVICE

By ordering Pacific Electric High Voltage Switching Equipment your engineering staff is augmented by our engineering service which has pioneered in the design of high-voltage switching equipment for over twenty years.

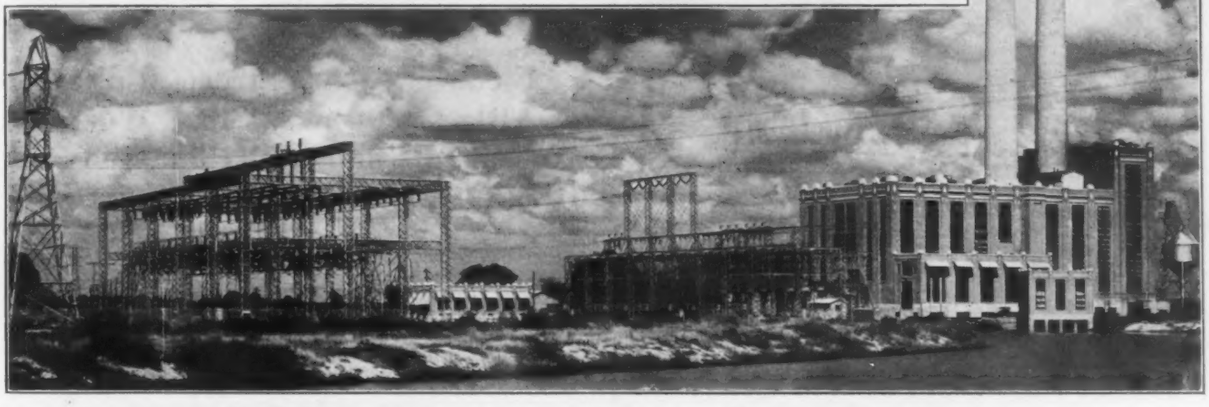
PACIFIC ELECTRIC DESIGNED AND MANUFACTURED EQUIPMENT INSTALLED AT THIS STEAM ELECTRIC STATION

132 KV. LINES

Oil Circuit Breakers, Current Transformers, By-Pass and Disconnecting Switches, Motor Controls and Grounding Switches.

73 KV. LINES

Oil Circuit Breakers, Current Transformers, By-Pass, Disconnecting, Bus Synchronizing and Grounding Switches, Choke Coils and Motor Controls.



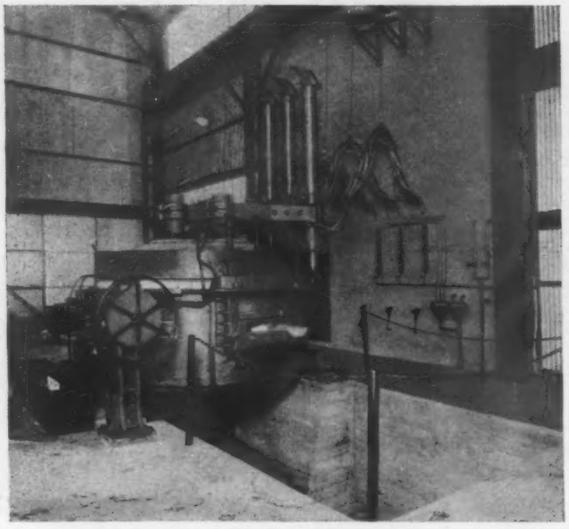
Pacific Electric Manufacturing Corp.

5815 THIRD STREET, SAN FRANCISCO, CALIF.

Representatives in Principal Cities

MOORE RAPID 'LECTROMELT FURNACES

The Load Builder of Today and Tomorrow



'LECTROMELT Basic Ingot Furnace in the Northwest

'LECTROMELT furnaces offer a most profitable source of load. Power Companies everywhere have found this form of load very desirable because of good balance and good power factor.

The Moore Rapid 'LECTROMELT furnace possesses many points of superiority. It is the result of 12 years of development, study and research. Its ease and accuracy of control and the high quality of its product are advantages which will make it of tremendous interest to many of your consumers.

Your 1928 load building program should include 'LECTROMELT furnaces for iron and steel melting.

'LECTROMELT
FURNACES MANUFACTURED
BY

PITTSBURGH ELECTRIC FURNACE CORPORATION

Pittsburgh, Pennsylvania — 419 Call Building, San Francisco, Calif.

Crapo
Galvanized Products

Telephone and Telegraph Wire

Steel Strand

THE Preece Test, universally recognized as the standard method for determining the uniformity of galvanized coatings, is adhered to religiously in the manufacture of all *Crapo* Galvanized Wire. Each day hundreds of these tests are run to keep constant check on all wire in the process of manufacture.

Crapo Galvanizing Process not only insures a uniform coating but likewise one of substantially pure zinc.

Representative Supply Jobbers are prepared to fill your requirements for *Crapo* Galvanized Wire and Strand on instant notice.

Indiana Steel and Wire Company
Muncie, Indiana. U.S.A.

Power Plant Piping

FOR

Electric Light, Street Railway, Blast Furnace, Steel Works and Industrial Plants of every description

PITTSBURGH PIPING & EQUIPMENT CO.
General Offices and Works, Pittsburgh, Pa.

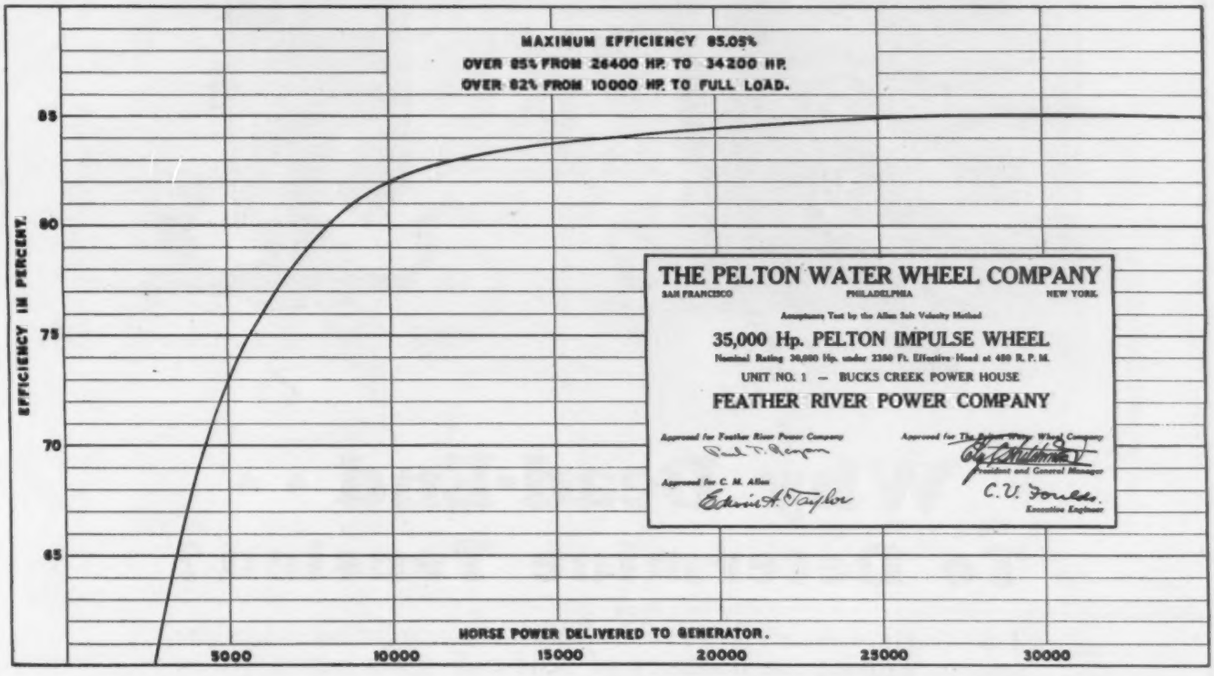
Western Representatives

JONES-LYMAN & CO., INC.

Russ Bldg., San Francisco — A. G. Bartlett Bldg., Los Angeles

PELTON

Remarkable Performance for Large Capacity Impulse Wheels



CAREFUL inspection of this official acceptance test curve for a modern Pelton impulse water wheel unit, built at our San Francisco works, will show the unusually high efficiency sustained over a wide range of power output.

This is one of two 35,000 Hp. double overhung units, which, with Pelton gate valves, governors, and exciter water wheel units, are installed under the record static head of 2548 feet.

Users of high head hydro-electric equipment will be interested in the results achieved by careful design and accurate workmanship, based on exhaustive preliminary research and tests.

Other large Pelton impulse units, now being built and installed on the Pacific Coast, are expected to show even higher efficiencies when placed in operation.

THE PELTON WATER WHEEL COMPANY

Hydraulic Engineers

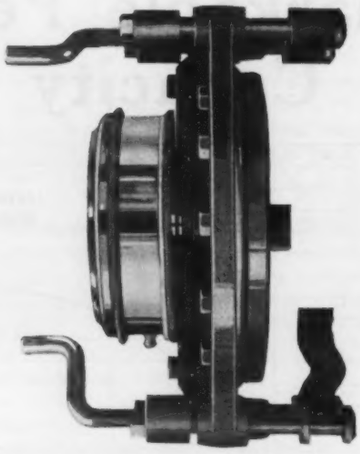
2985 Nineteenth St., SAN FRANCISCO **100 Broadway, NEW YORK**

Associated Companies: I. P. Morris Corporation, Philadelphia, Pa.; Dominion Engineering Works, Ltd., Montreal.

Pacific Coast Representative for Larner Engineering Co., Philadelphia, Pa.; De La Vergne Machine Co., New York, N. Y.

PELTON

The Tension Indicator on a guy line.



Just open the clips, insert wire and tighten.

Why Dead-End . . To Determine Tension?

The Martin-Loomis Tension Indicator accurately measures the tension without the necessity of dead-ending or cutting wires.

Heretofore, in order to determine the tension on guys or conductors, it has been necessary to cut or dead-end the wire. Now with the Martin-Loomis Tension Indicator simply clamp the instrument to the wire either *before, during* or *after* tension has been applied. It will accurately indicate tensions to a maximum of 16,500 lb. on any wire or cable up to a diameter of one inch.

This instrument operates on an hydraulic pressure principle, the tension on the wire exerting pressure on a diaphragm supported by water. Readings may be either in pressure, readily converted with calibration curves, or direct with special dial faces. The indicator weighs only 11½ lb. and may be handled easily even in awkward positions.

Calibration curves for various types and sizes of wire and cable are available.

The Tension Indicator may be used to:

"Sag-in" transmission and distribution lines.

Determine guy line strains on anchors.

Determine types of tower footings best suited to various soils.

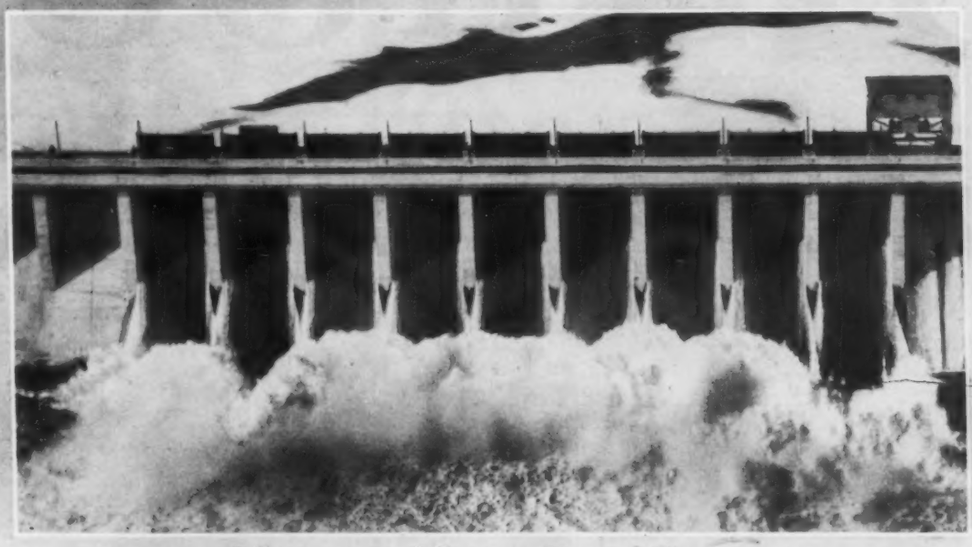
Adjust load proportionately on two or more guys on the same pole.

These are only a few of its many uses.

Write for literature and further information.

MARTIN-LOOMIS CORPORATION

568 East Willow Street **Long Beach, California**



Newport News Crest Gates Going Into Action at Conowingo

Fifty of these gates, each 40 ft. wide, 22 ft. 6 in. high and weighing 42 tons are now in service at this development. They were shipped completely assembled and ready for installation.

In addition, there is also the following NEWPORT NEWS equipment at Conowingo:

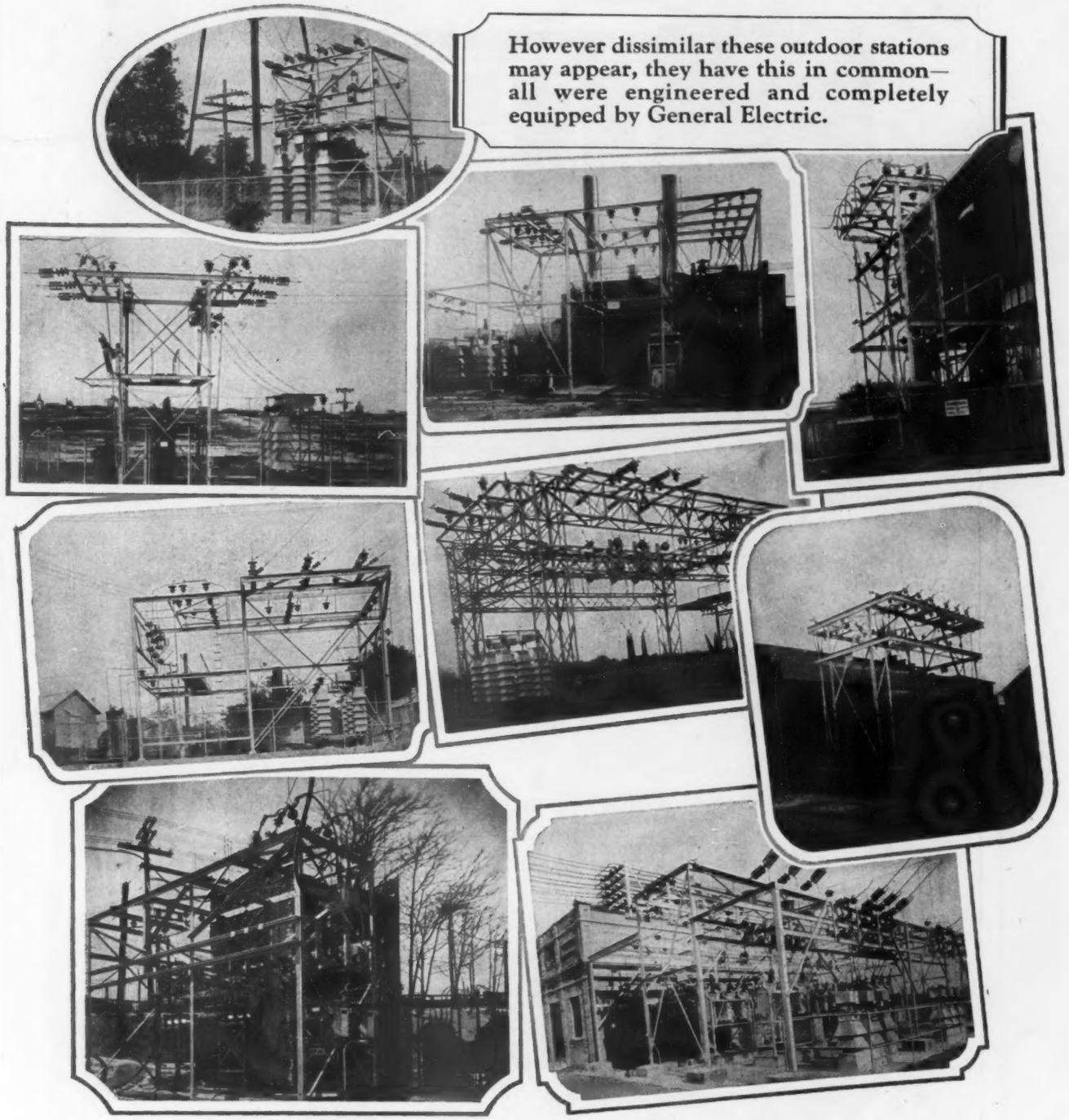
3 REGULATING GATES
1 SERVICE GATE
4 SECTIONAL HEAD GATES
2 STATION SERVICE HEAD GATES
40 STOP LOGS
8 STOP LOG SEALS
1 MECHANICAL RACK RAKE
1 STATION SERVICE STOP LOG
8 DRAFT TUBE STOP LOGS
70 RACKS
28 RACK FRAMES
2 STATION SERVICE RACKS
4 STATION SERVICE RACK FRAMES
GUIDES FOR ALL GATES, STOP LOGS AND RACKS

TOTAL WEIGHT OF ALL EQUIPMENT—5463 TONS

Hydro-Electric Division

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY
NEWPORT NEWS, VIRGINIA NEW YORK: 233 BROADWAY
CHARLOTTE, NORTH CAROLINA

Outdoor

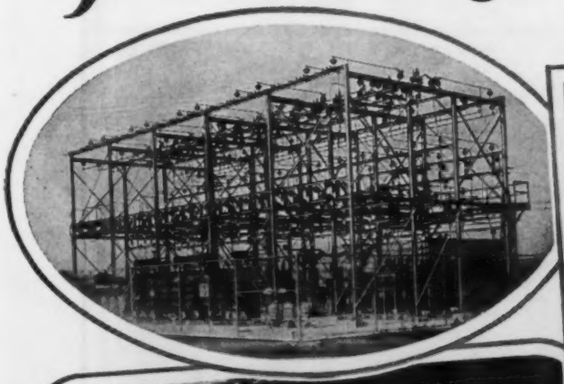


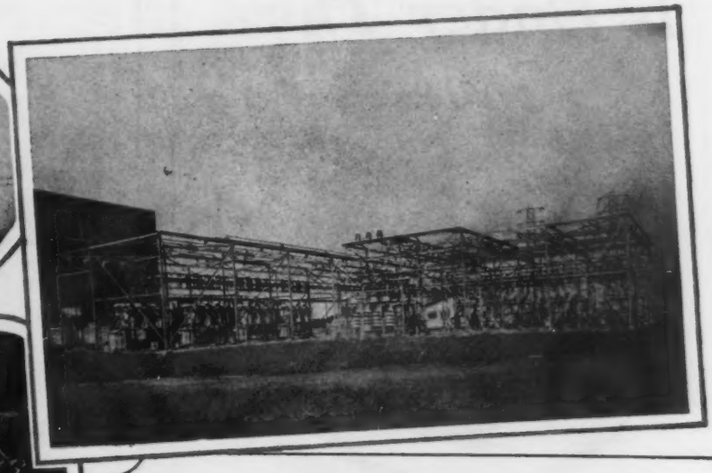
However dissimilar these outdoor stations may appear, they have this in common—all were engineered and completely equipped by General Electric.

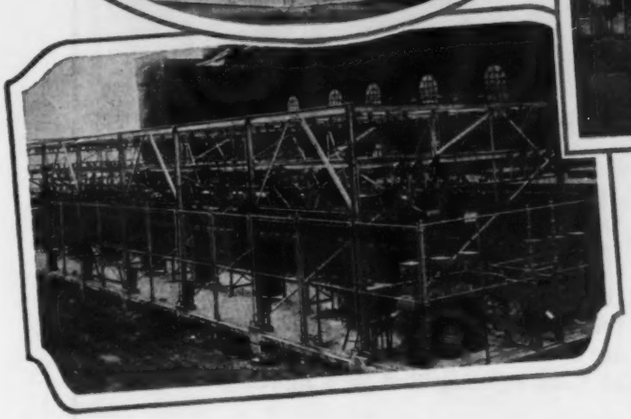
GENERAL

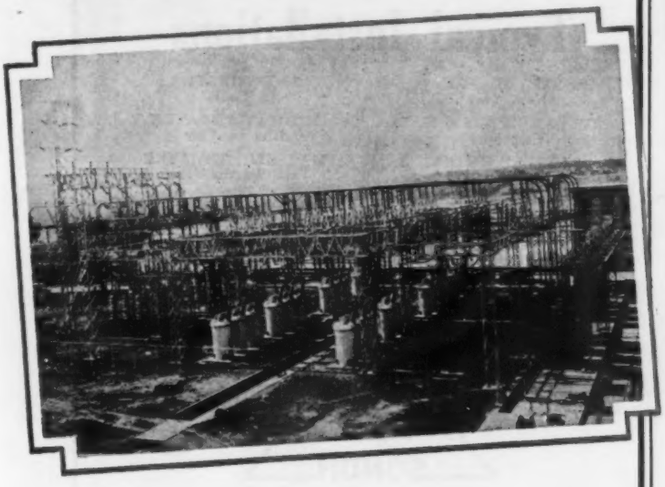
GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

Stations
for every type of service









For every type of service, for every load condition, General Electric is prepared to furnish complete outdoor stations. Years of experience in coördinating equipment to fit existing conditions exactly is your guarantee that, when manufactured by General Electric, your station will afford economical control and protection for your generating and distributing apparatus.

Your purchase of G-E outdoor station equipment is your assurance of a permanent source of renewal parts and the services of a nation-wide organization of specialists. For complete information on these equipments, refer to the nearest G-E sales office.

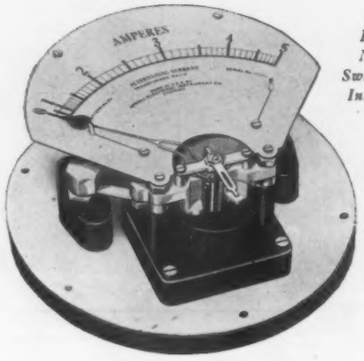
500-25

ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES

JEWELL

WHAT Is Under The Cover



Pattern No. 30 Switchboard Instrument

Do you take the covers off the instruments you buy and look inside to see what you are getting for your money?

A beautiful attractive exterior appearance in such a highly specialized device as an electrical instrument is very desirable, but it may easily hide an inferior mechanism.

Let us see what is under the cover of the Jewell Pattern No. 30 switchboard instrument.

The movement of the Jewell Pattern No. 30 is an example of the masterful design of their line of instruments. It contains many features found only in Jewell instruments, and its design and construction incorporate the latest and most advanced knowledge of instrument manufacture. Better and greater insulation. Larger and clearer scales. A stronger and more accurate movement with many outstanding improvements. A 4000% amperage overload test, sufficient to wreck most instruments, has not rendered it inaccurate when rechecked on normal currents. It is truly a Jewell instrument.

It will pay anyone to investigate this instrument, if for no other purpose than to have a new standard of comparison by which to judge other switchboard instruments.

Write for a copy of our new general catalog No. 16, which describes and lists all Jewell switchboard and portable instruments in detail.

Jewell Representatives

Nixon-Kimmel Co., Spokane
Eicher & Bratt, Colman Bldg., Seattle
C. F. Henderson, Call Bldg., San Francisco
Thomas Machinery Co., 912 E. 3rd St., Los Angeles
J. W. Van De Grift Co., Denver

"28 Years Making Good Instruments"

Jewell Electrical Instrument Co.
1650 Walnut Street, Chicago

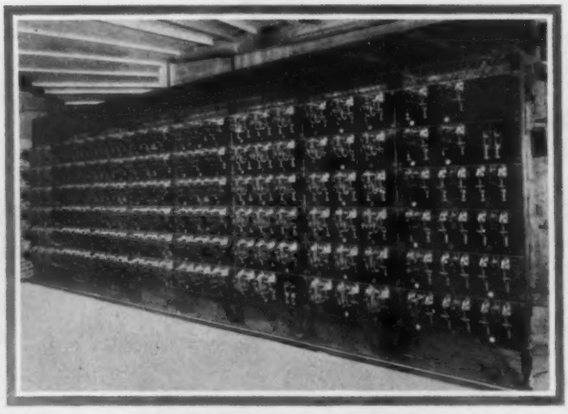
Pattern No. 30

The long bold scale and plain front make reading easy

CONTROL

for Lighting Effects

by SUNDH



Contactor board installed by Hub Electric Co. in Malaikah Temple, Los Angeles, California.

SUNDH CONTACTORS

are used by leading architects and engineers from coast to coast to obtain best effects in theatres, ball rooms and auditoriums. They are used inside on lighting effects and outside on flood lighting and sign lighting.

Typical Installations

ROXY THEATRE
New York

FOX THEATRE
St. Louis

CLEVELAND PUBLIC HALL
Cleveland

MIDWAY THEATRE
Kansas City

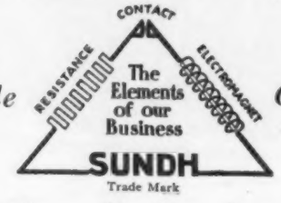
STEVENS HOTEL
Chicago

MAJESTIC THEATRE
Fort Worth, Texas

AL MALAIKAH TEMPLE, Los Angeles

Sundh Electric Co., Inc.

Reliable



Control

Parkhurst Station, Ave. C.,
Newark, N. J., U. S. A.

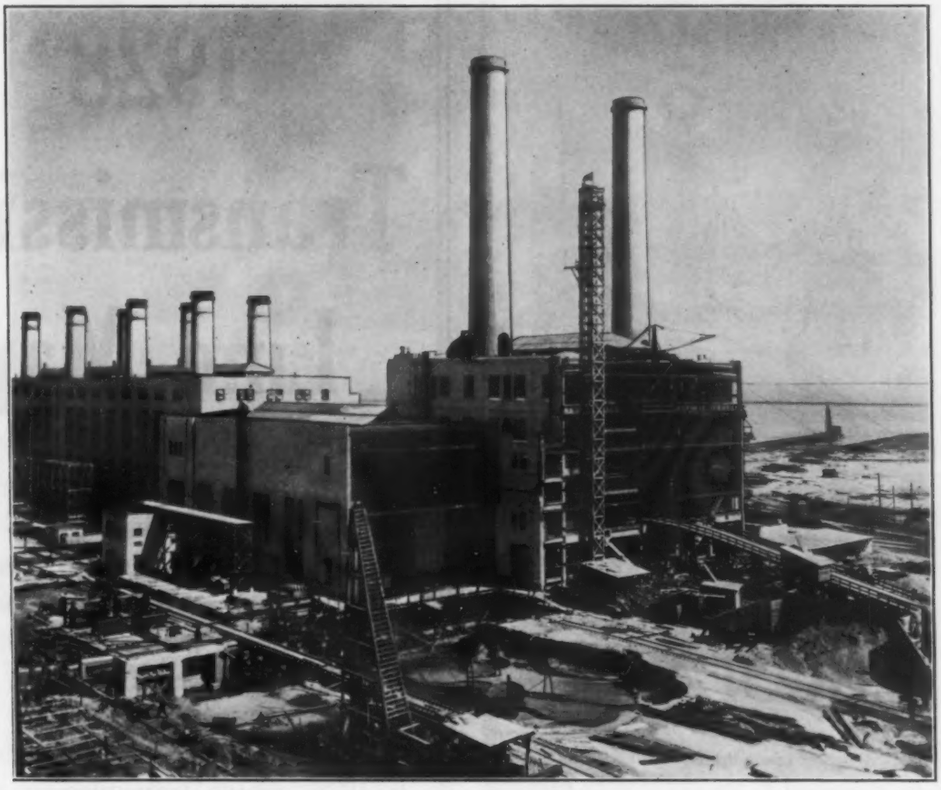
Pacific Coast Representatives

Jones-Lyman & Co., Inc.
Russ Bldg., San Francisco

T. S. Wood
505 Polson Bldg., Seattle

The Demmert Co.
106 W. 3rd St., Los Angeles

Joy & Cox
314 Tramway Bldg.,
Denver, Colo.



More Power For You!

WITH the completion of the first of eight new, 125,000 horsepower units of the Long Beach Steam Plant, this company has provided a substantial addition to the power supply of Southern California. While this new generating unit will represent but one-eighth of the present total generating capacity of the Southern California Edison Company it will provide sufficient power to operate thousands of electric ranges, refrigerators, water heaters, washing and ironing machines, vacuum cleaners, percolators, waffle irons and the dozens of other household appliances.

The electrical construction engineer is far ahead of the electrical merchandiser. There is power enough now for all needs and additional power may be added quickly. Now it is squarely up to the electrical merchandiser to create new outlets for it.

Southern California

EDISON COMPANY

Owned by Those It Serves

IMBOLA

The white ochre smeared on a Kaffir's face to indicate that he is a newly made man, is called **imbola.**

It is a mark symbolical of the fact that he has passed all tests and is no longer a novice.

We think of that every time we hear that someone has brought out a new stunt in carbon brushes.

And we wonder what **imbola** mark he can give to assure operators that it has passed all tests and is not an experiment. . .

. . . a mark that carries exactly the significance of the 3-link mark on all Morganite brushes.

. . . and then we smile as we hear Old Man Futility say, "It can't be done."

Morganite Brush Co., Inc.

Main Office and Factory
3302-3320 Anable Ave., Long Island City, N. Y.

DISTRICT ENGINEERS AND AGENTS

Los Angeles, Electrical Engineering Sales Co., 502 Delta Building.
San Francisco, Electrical Engineering Sales Co., 222 Underwood Building.
Pittsburgh, Electrical Engineering & Mfg. Co., 909 Penn Ave.
Cincinnati, Electrical Engineering & Mfg. Co., 607 Mercantile Library Building.
Cleveland, Electrical Engineering & Mfg. Co., 320 Union Building.
Baltimore, O. T. Hall, Sales Engineer, 432 North Calvert St.
Revere, Mass., J. F. Drummery, 75 Pleasant Street.
Toronto, Can., Railway & Power Engineering Corp., Ltd., 101 Eastern Ave.
Montreal, Can., Railway & Power Engineering Corp., Ltd., 68-70 St. Antoine St.
Winnipeg, Can., Railway & Power Engineering Corp., Ltd., P. O. Box 325.

1928 Transmission Line Map

ELECTRICAL WEST has corrected the tracings from which the map entitled "Western Hydro-electric Systems" was made in 1925. We are in a position to furnish brown prints 54 by 45 inches from these corrected tracings.

The map, corrected as of February 1, 1928, shows transmission systems, power houses, and points of interconnection for all of the principal light and power companies of the eleven Western states.

The price of the map is $10. For $13 the map will be furnished mounted on linen ready for hanging on the wall.

For further information write to the Business Department.

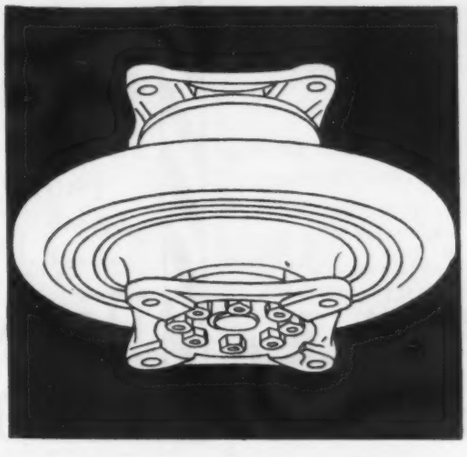
Electrical West
883 Mission Street San Francisco

... All J-D Thick Porcelain Cementless Insulators are designed to eliminate the difficulties which interfere with continuous service. They are symbols of long service and dependability in the efficient insulating of high voltage throughout the world.....

JEFFERY-DEWITT

INSULATOR COMPANY

KENOVA · · · WEST VIRGINIA



New De Laval
Insulating Oil Purifier

DE LAVAL presents an entirely new insulating oil maintenance outfit combining in a compact, all-steel, portable unit the following features:

Centrifugal Oil Purifier of greater efficiency and higher capacity than any heretofore supplied for services requiring easy portability.

Direct-connected blotter press for use in connection with the centrifugal for purifying carbonized circuit breaker oil.

Self-starting Purifier with push-button control.

Push-button controlled rotary pumps capable of operating against 100-lb. pressure.

Three-unit electric heater equipped with thermostatic cut-out.

Easier cleaning of the Purifier bowl.

Four roller-bearing wheels with wide tires.

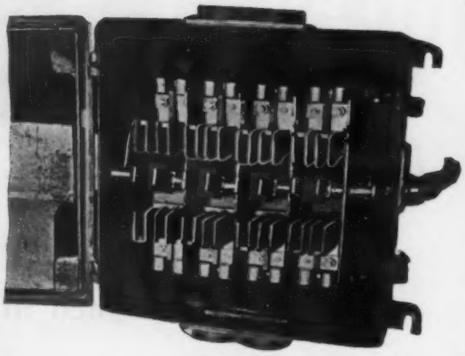
Write today for full details of this most modern Insulating Oil Purifier.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 600 Jackson Blvd., Chicago

DE LAVAL PACIFIC COMPANY, 61 Beale St., San Francisco.
THE DE LAVAL COMPANY, Ltd., Peterborough and Winnipeg, Canada.
ALFA-LAVAL CO., Ltd., 34 Grosvenor Road, London, S.W. 1.

DE LAVAL
OIL PURIFIERS
Types for Lubricating Oil and Insulating Oil

The Finest Safety Switch Ever Built!



We feel justified in calling this T-V Current Breaker the finest Safety Switch ever built.

It is a special switch with cast iron box, built for one of the large steel mills.

It is a 400 ampere, 4 pole, unfused, double-throw, double-break switch.

Unlike most double-throw switches, this particular one had to be capable of operating under full load. It works perfectly without dangerous arcing.

This type of Current Breaker Construction eliminates wiring to the hinge in this double-throw switch, and permits the reversal of live and load connections at either end.

We have built another special switch, similar in design to the one above, rated at 800 amperes, 250 volts D.C. for a large eastern Traction Company.

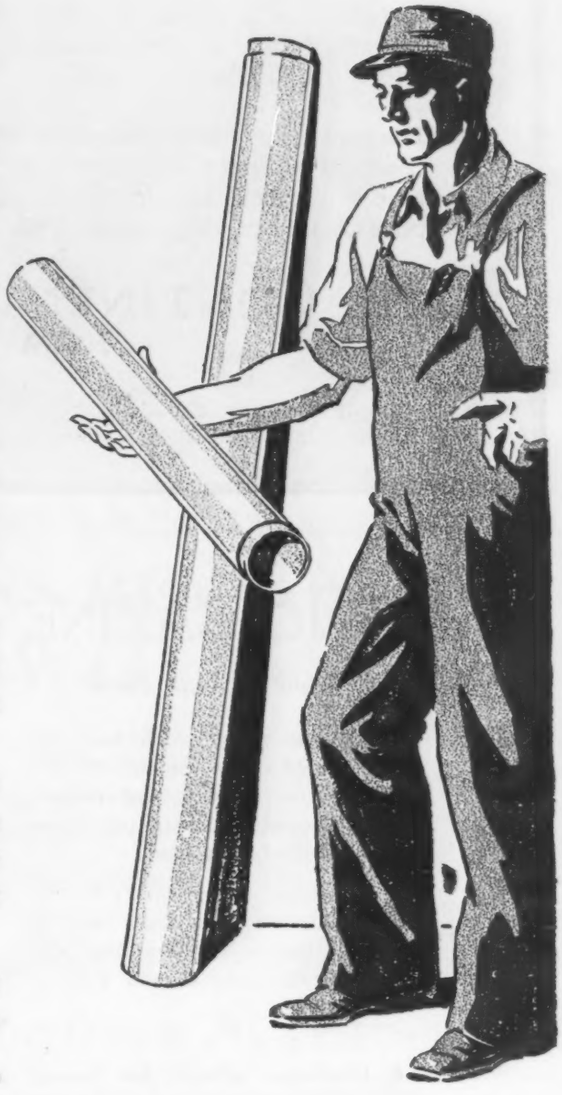
This switch, in a test, successfully broke 1800 amperes fifty-one times without dangerous arcing.

These switches are examples of the special work we are called upon do from time to time in the manufacture of exceptional safety switches. Our regular line is still the most complete line in the world.

TRUMBULL-VANDERPOEL ELECTRIC MFG. CO.
BANTAM, CONN.
On the Pacific Coast—C. Dent Slaughter

TV SAFETY SWITCHES

Orangeburg Fibre Conduit Combines Lightness and Ease of Handling



For over 30 years Orangeburg Conduit has served as the ideal duct for carrying all types of underground wires or cables.

All over the world Orangeburg Conduit is used for electric light, power and telephone cables. Public utility companies and municipalities everywhere have learned, through long experience, that Orangeburg Conduit gives complete protection at moderate cost.

Orangeburg Conduit is a homogeneous fibrous tube thoroughly impregnated with a preservative and waterproofing compound. It will not corrode.

It is light in weight and is made in lengths which experience has shown may be more conveniently and economically laid than either longer or shorter lengths.

JOHNS-MANVILLE CORPORATION
New York Chicago Cleveland San Francisco
For Canada:
Canadian Johns-Manville Co., Ltd., Toronto

The Fibre Conduit Co.

ORANGEBURG, NEW YORK

Johns-Manville
CORPORATION
SOLE SELLING AGENTS

Dilecto Tubing—
A Continental Product

By a unique process of pressing together various types of impregnated papers and fabrics under terrific pressure and temperature, it has been possible to produce a laminated phenolic tubing, the practicability of which is unlimited.

Dilecto tubing has unbelievable mechanical strength and at the same time is unexcelled for insulation purposes. It is readily susceptible to machining and can in fact be threaded as readily as metal.

This product has found wide distribution throughout the electrical field where its extremely high dielectric strength and resistance to moisture has been recognized.

Dilecto tubing can be obtained in diameters ranging from 1/8" to 12½" in any thickness of wall specified.

THE CONTINENTAL FIBRE COMPANY

NEWARK, DELAWARE

Service from:

New York . 250 Park Ave.
Chicago . . Wrigley Bldg.
San Francisco 1575 Folsom St.
Los Angeles . 307 S. Hill St.
Seattle . 1041 Sixth Ave., So.

THIS MAGAZINE

Was Printed in Our Plant

¶ Perfect press work and register of color throughout this book are the result of modern presses plus painstaking efforts of skilled pressmen.

¶ Whatever YOU may have in printing or bookbinding will have the same careful consideration.

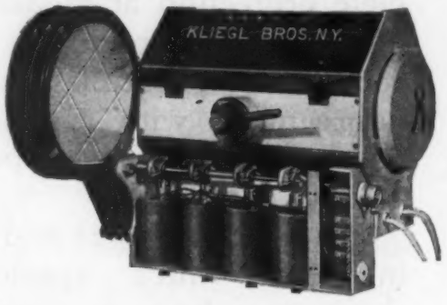
¶ Catalogue covers for bound or loose leaf catalogues are a specialty with us.

NEAL, STRATFORD & KERR

Stationers, Printers, Bookbinders

521 Market Street Russ Building
San Francisco

Phone Sutter 5886
Plant—414 Mission Street



Announcing a new Spotlight with an electro-magnetic device for remote control of its color frames—permitting an endless variety of changing color-lighting effects—all controlled from a central point. A group of these spotlights can be simultaneously operated just as easily as one. For use in theatres, ballrooms, auditoriums, show windows, exhibits, etc.

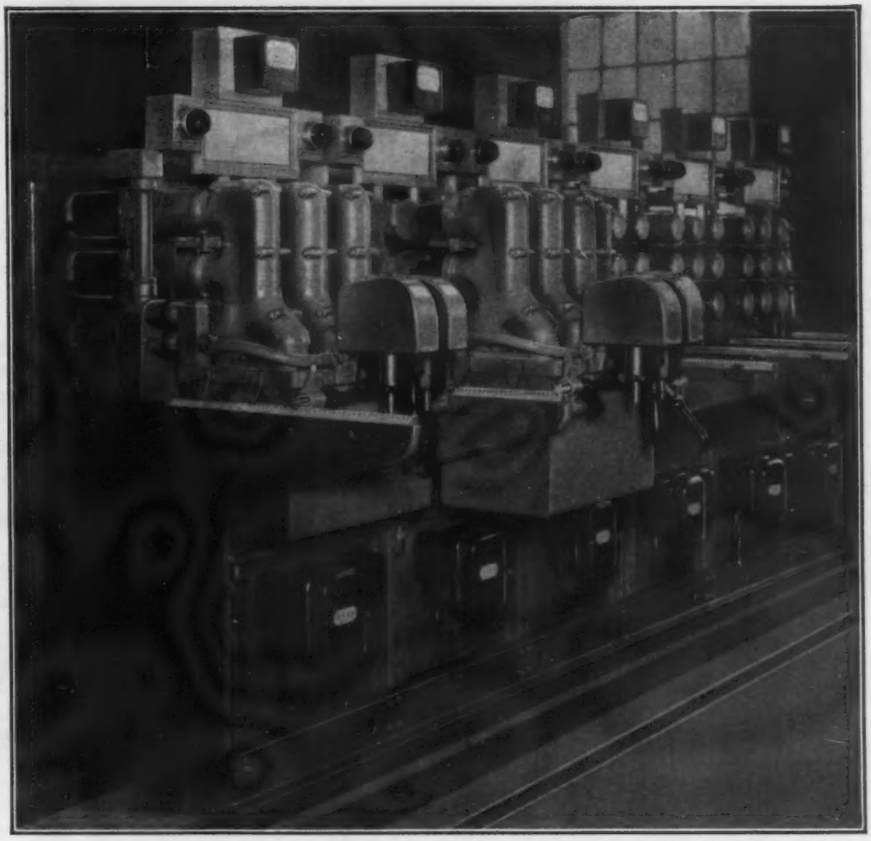
Write for Bulletin 3 which gives an interesting description of this new Spotlight and its many advantages—together with Trade information, prices, etc.

KLIEGL BROS

UNIVERSAL ELECTRIC STAGE LIGHTING CO., INC.

321 WEST 50th STREET

NEW YORK, N.Y.



6 Type 2C1 Duplicate busbar switchgear units assembled for shipment.

ALLIS-CHALMERS REYROLLE ARMORCLAD SWITCHGEAR

Compound Filled.

Provides the maximum protection to operators and equipment.

Unit shipment simplifies erection.

Compact — Accessible — Rugged
Tested in service for over 20 years

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

PACIFIC COAST OFFICES: Rialto Building, San Francisco, Calif.; 622 Title Insurance Building, Los Angeles, Calif.; 115 Jackson Street, Seattle, Wash.; 505 Lumbermen's Building, Portland, Ore.; 525 Symes Building, Denver, Colo.; 915 Kearns Building, Salt Lake City, Utah; 308 Heard Building, Phoenix, Ariz.; 619 Frost National Bank Building, San Antonio, Texas.

READY REFERENCE FOR WESTERN BUYERS

"WESIX HEATERS"

Radiant Convection Type
Flush wall type, Portable, Bracket, Floor and Andiron Fireplace Type
AUTOMATIC ELECTRIC WATER HEATERS

W. WESLEY HICKS
Patentee Manufacturer
Rialto Bldg. San Francisco

Licensed Manufacturers
GULF ELEC. AP. CO. 28th and Long Sts. Tampa, Fla.
M. L. HOOPER, 639 S. San Pedro St., Los Angeles
H. V. MOONEY, 2010 Third St., Seattle

LOS ANGELES PORTLAND SPOKANE
OAKLAND SAN FRANCISCO SEATTLE
PHOENIX LONG BEACH SAN DIEGO

PACIFIC STATES
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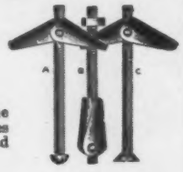

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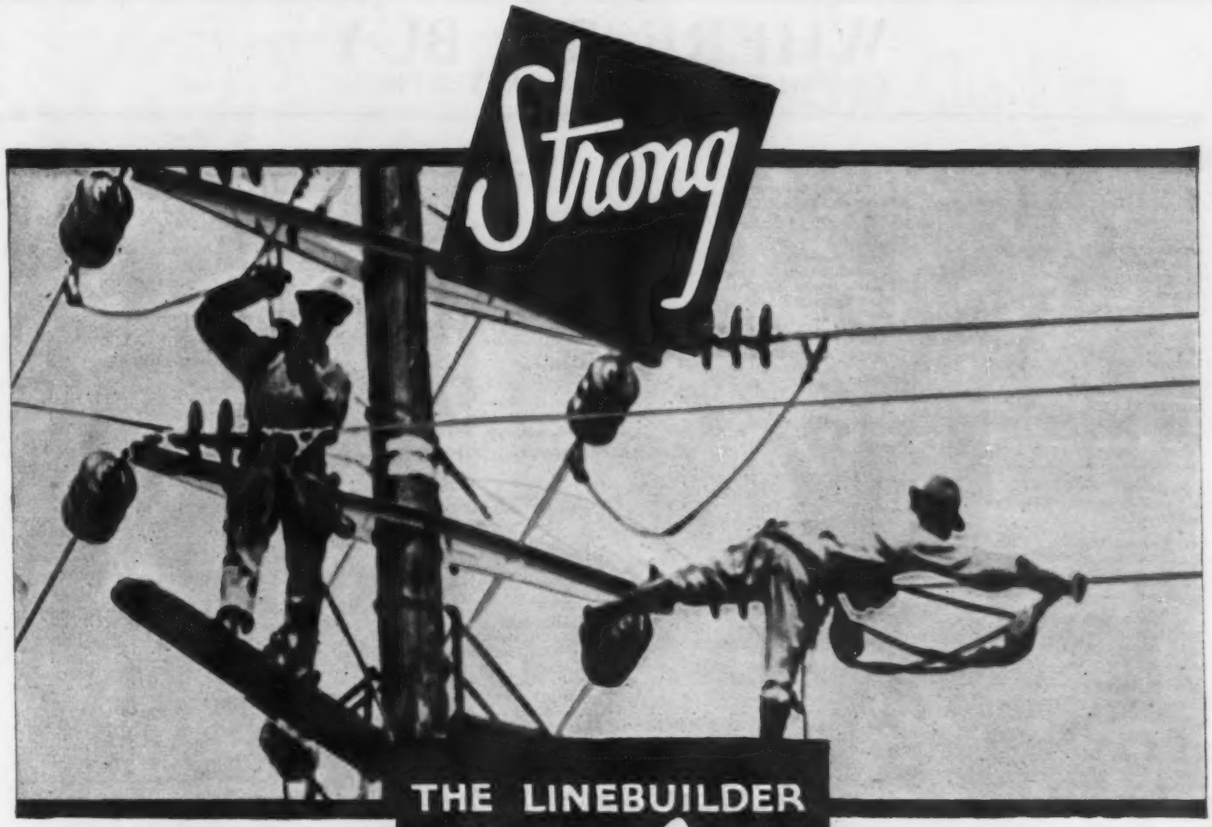

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Pelton Water Wheel Co.
Smith Co., S. Morgan

Washing Machines
Altorfer Bros. Co.
Domestic Appliance Co., Inc.
Fairbanks, Morse & Co.
Graybar Electric Co., Inc.
Pacific States Electric Co.

Welding Apparatus
General Electric Company
Graybar Electric Company, Inc.
Ohio Brass Co.
Pacific States Electric Co.
Westinghouse Elec. & Mfg. Co.

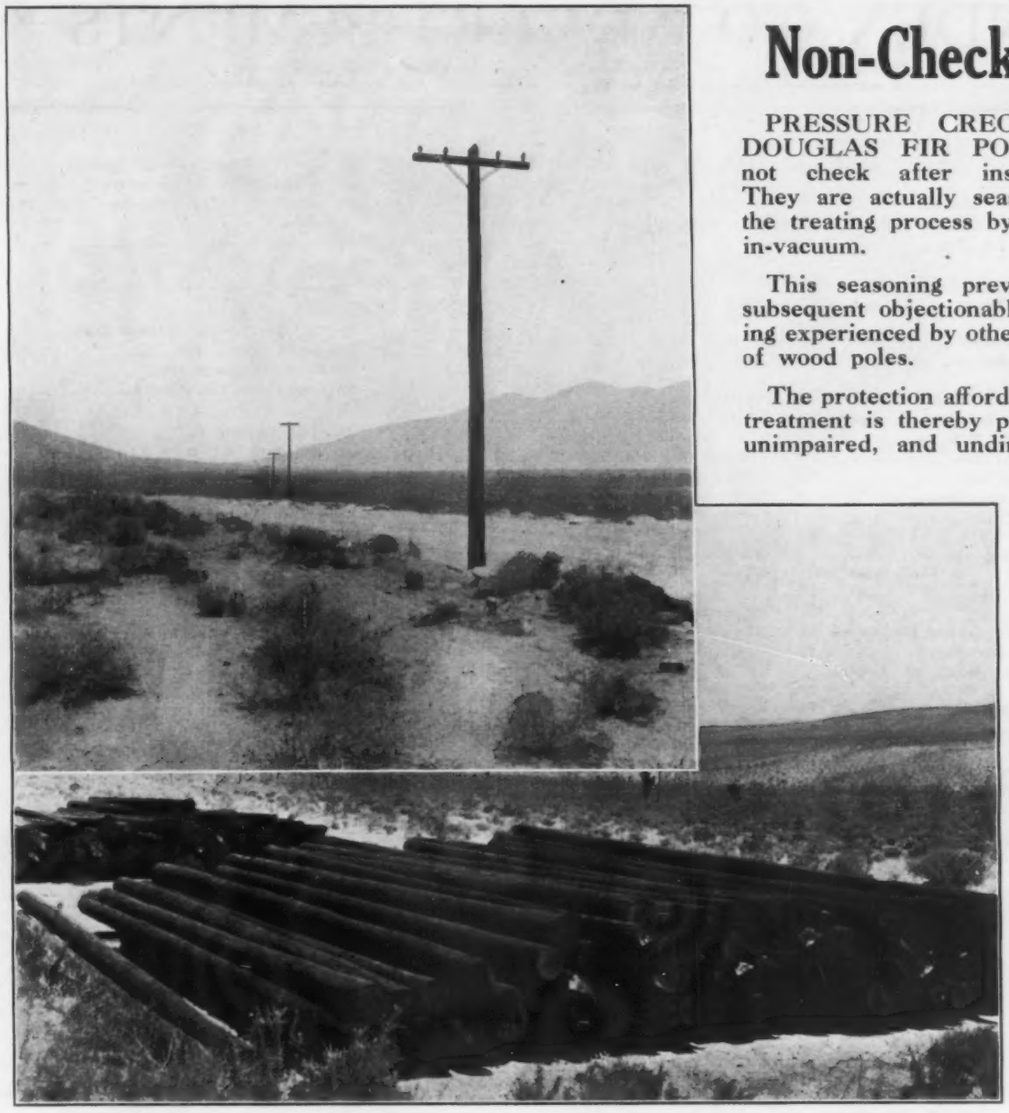
Wire: Aluminum
Aluminum Co. of America

Wire: Asbestos Covered
Rockbestos Products Corp.

Wire: Bare and Insulated Copper
Allied Industries, Inc.
American Brass Company
Anaconda Copper Mining Co.
California Wire & Cable Co.
Collyer Insulated Wire Co.
Graybar Electric Company, Inc.
Indiana Rubber & Ins. Wire Co.
New York Insulated Wire Co.
Okonite-Callender Cable Co., Inc.
Okonite Company, The
Pacific States Electric Co.
Providence Insulated Wire Co.
Roebling's Sons Co., John A.
Standard Underground Cable Co.
Triangle Conduit Co.
Tubular Woven Fabric Co.

Wire: Galvanized Steel
Graybar Electric Co., Inc.
Indiana Steel & Wire Co.
Okonite-Callender Cable Co., The
Okonite Company, The
Pacific States Electric Co.
Standard Underground Cable Co.

Wiring Devices
Allied Industries, Inc.
Bryant Electric Company
Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey
Pacific States Electric Co.
Paulding, Inc., John I.



Non-Checking

PRESSURE CREOSOTED DOUGLAS FIR POLES do not check after installation. They are actually seasoned in the treating process by boiling-in-vacuum.

This seasoning prevents the subsequent objectionable checking experienced by other species of wood poles.

The protection afforded by the treatment is thereby preserved, unimpaired, and undiminished.

ABOVE—Creosoted Fir Poles in Los Angeles Aqueduct telephone line, Owens Valley, California.

BELOW—Creosoted Fir Poles that have lain in piles over a year, exposed to severe extremes of heat and cold, Loco Siding, Owens Valley. Note absence of checks.

Pressure Creosoted DOUGLAS FIR *Poles*

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Pacific Creosoting Co., Seattle, Wash.
Chas. R. McCormick Lbr. Co.,
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California Distributors

J. H. Baxter & Co.,
San Francisco and Los Angeles, Calif.
Chas. R. McCormick Lbr. Co.,
San Francisco and Los Angeles, Calif.

ENGINEERING REPRESENTATIVES—Farnham & Cunningham, Los Angeles, Calif.

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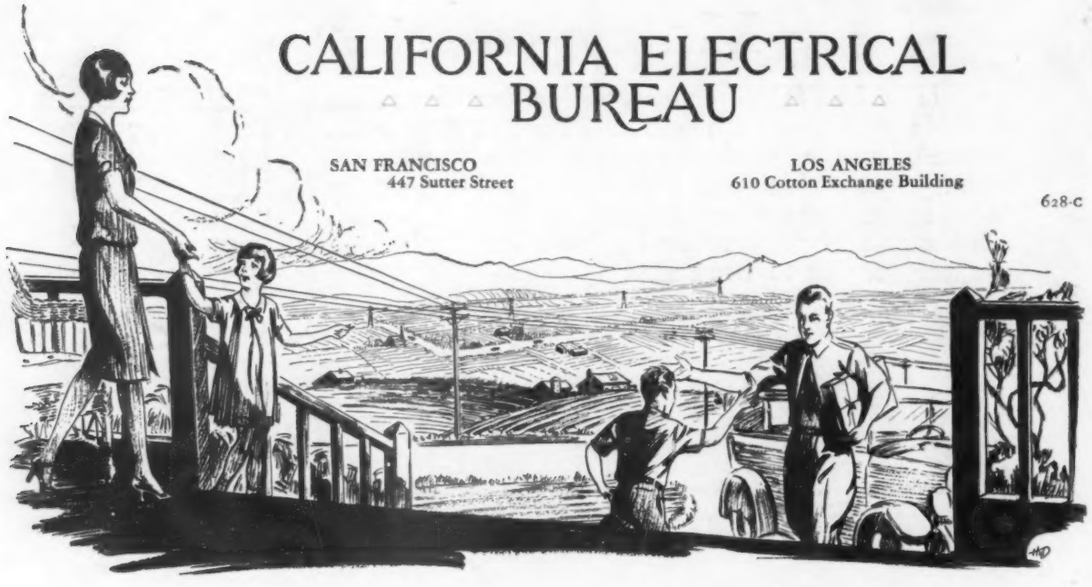

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